Summary Report for the Peer Review on the Use of Asbestos as a Surrogate Contaminant for Determining the Risk from Other Contaminants

Prepared by:

Eastern Research Group, Inc.
110 Hartwell Avenue
Lexington, MA 02421

Prepared for:

U.S. Environmental Protection Agency
National Center for Environmental Assessment
Washington, DC

Contract 68-C-02-060
Task Order 59

April 29, 2004

Contents

1. Introduction

1.1 Background

After the collapse of the World Trade Center (WTC) towers, the U.S. Environmental Protection Agency (EPA) and other federal, state, and local agencies began the process of assessing potential health concerns resulting from exposure to WTC dust. In addition, agencies began cleaning up the dust contaminants in the indoor environment, including residences, business offices, stores and other commercial areas near Ground Zero. Planning, which began in March 2002, and indoor environment cleanup activities proceeded under three concurrent programs. One program focused on identifying WTC contaminants of potential concern (COPCs) and developing health-based benchmarks associate with indoor residential exposure. A second program evaluated the effectiveness of the chosen cleaning methods by conducting before and after cleaning sampling on a limited number of impacted apartments. The third program was the actual residential cleanup program itself.

EPA determined that the COPCs included lead, polycyclic aromatic hydrocarbons (PAHs), asbestos, dioxin, fibrous glass, and crystalline silica. Employing toxicological information along with exposure assumptions in a scenario-based assessment approach, EPA's Region 2 developed risk-based benchmark concentrations for these COPCs. These benchmarks were developed during spring and summer 2002. In October 2002, an external peer review panel met in New York City to review the document on these benchmarks, titled, *World Trade Center Indoor Air Assessment and Selection of Contaminants of Concern and Setting Health-Based Benchmarks*. The final document, which addressed the panel's comments, was completed by EPA Region 2 in May 2003.

A second program focused on evaluating the efficacy of the proposed WTC dust cleaning and vacuuming methods. EPA Region 2 selected a heavily impacted building on Liberty Street and conducted the "Confirmation Cleaning Study," which began cleaning and testing apartments on June 12, 2002. Various cleanup methods, including those used in the volunteer residential cleanup program, were evaluated in this study. Baseline (pre-cleaning) and post-cleaning air and dust samples were collected throughout the building. The study found that a combination of wet wiping and vacuuming was mostly sufficient to reduce levels of contaminants below the benchmark concentrations developed for the residential cleanup program. Based on an analysis of the results from this study, "conducting asbestos air sampling was a conservative method for determining if additional cleaning was required." A draft report, titled *Interim Final WTC Residential Confirmation Cleaning Study,* was made available to the public in May 2003.

Under the third program, EPA Region 2 announced the voluntary cleanup program to the public in May 2002. Cleaning began in September 2002 and continued until June 2003. The program cleaned and/or tested about 4,200 apartments in 480 buildings. An apartment was deemed cleaned if asbestos measurements were below the benchmark.

During 2003, EPA, the White House Council on Environmental Quality, and Senators Clinton and Lieberman discussed and reached an agreement about ongoing actions to assess the

impacts of the WTC disaster. As a result, EPA created a WTC expert technical panel to address concerns and issues outlined in the agreement. One task outlined was evaluating the conclusion that asbestos was an appropriate surrogate in determining risk for other contaminants. This is a key question to answer prior to undertaking a post-cleaning verification sampling program to ensure protection of public health. In spring 2004, EPA charged Eastern Research Group, Inc. (ERG), an EPA contractor, with a task to conduct an independent expert peer review to address the specific issues regarding asbestos use as a surrogate. This report summarizes the results of that independent review.

1.2 The Review Process

ERG was charged by EPA with assembling a review panel consisting of five experts who met the following qualifications criteria: they should have multiple expertises, including but not limited to, the following disciplines: indoor air quality, indoor air monitoring methodologies, indoor exposure and risk assessment methodologies, public health, toxicology, and risk characterization. Further considerations included:

- The peer review panel must have specific expertise on the contaminants that were considered for EPA's indoor cleanup program. Of greatest importance is expertise in exposure, monitoring methodologies, and health risk for asbestos. However, expertise in the other contaminants considered to be of risk for WTC indoor residential exposures should also be considered. These other contaminants include dioxin, polycyclic aromatic hydrocarbons (PAHs), fibrous glass, crystalline glass, and lead.

- Individuals currently serving on the World Trade Center Expert Technical Review Panel are excluded from consideration. However, individuals who have provided comment to key EPA World Trade Center reports, as part of other panels or otherwise, are not excluded. These reports include:

    - The EPA National Center for Environmental Assessment's risk assessment, *Exposure and Human Health Evaluation of Airborne Pollution from the World Trade Center Disaster.*
    - EPA Region 2's report on contaminants of potential concern, *World Trade Center Indoor Air Assessment and Selection of Contaminants of Concern and Setting Health-Based Benchmarks*.

- Peer reviewers should have no conflict of interest associated with any World Trade Center activities that would render them inappropriate to provide review comments on the asbestos clean-up topic of the peer review.

As a first step in the peer review, ERG conducted a search to identify candidate reviewers that met these criteria. ERG reviewed the qualifications of a number of candidates and forwarded the names and resumes of eleven candidates to EPA to provide the agency with the opportunity to identify any conflict of interest or other concerns, should they exist, with respect to the candidates. EPA had no comments on the candidate reviewers. ERG then selected five peer

reviewers from the proposed pool of candidate reviewers. The final panel consisted of the following experts:

Dr. Gary L. Ginsberg, Ph.D., a toxicologist at the Connecticut Department of Public Health within the Toxic Hazards Assessment Unit.

Dr. Annette Guiseppi-Elie, Ph.D., a senior consultant on exposure and risk assessment issues for the DuPont Company.

John R. Kominsky, M.Sc., CIH, CSP, CHMM, Vice President of Environmental Quality Management, Inc. and an Adjunct Associate Professor in the Department of Environmental Health at the University of Cincinnati.

Robert P. Nolan, Ph.D., Deputy Director of the Center for Applied Studies of the Environment and a member of the Doctoral Faculty (Chemistry and Earth & Environmental Sciences) at the Graduate School and University Center of The City University of New York.

Dr. Clifford P. Weisel, Ph.D., Professor of Environmental and Community Medicine at the University of Medicine and Dentistry of New Jersey-Robert Wood Johnson Medical School, and Deputy Director of the Exposure Measurement and Assessment Division of the Environmental and Occupational Health Sciences Institute.

Information on the peer reviewers can be found at http://www.epa.gov/wtc/panel/pdfs/exp-bios.pdf

ERG provided the reviewers with a number of documents to assist them in addressing this question:

- *World Trade Center Indoor Air Assessment and Selection of Contaminants of Concern and Setting Health-Based Benchmarks*
- *Interim Final WTC Residential Confirmation Cleaning Study*
- *World Trade Center Background Study Report*
- *Report on the Region 2 Indoor Clean-up Program (draft)*
- *Exposure and Human Health Evaluation of Airborne Pollution from the World Trade Center Disaster*
- *Characterization of Particulate Found in Apartments After Destruction of the World Trade Center*
- *Ambient and Indoor Sampling for Public Health Evaluations of Residential Areas Near the World Trade Center*

- *Final Report of the Public Health Investigation to Assess Potential Exposures to Airborne and Settled Surface Dust in Residential Areas of Lower Manhattan*

ERG also gave the experts a Charge to Reviewers, provided in Appendix A. Charge questions were developed by EPA. The Charge to Reviewers briefly discusses background information about the issue under consideration and lists three charge questions that reviewers should address in their evaluations:

Q1. Do the data in the Confirmation Cleaning Study, and any other data or findings, support the selection of asbestos in air as an appropriate surrogate for determining the risk from other contaminants?

Q2. Do other contaminants that were measured in the Confirmation Cleaning Study provide equally good or better surrogates for determining the risk from other contaminants?

Q3. Do the reviewers know of any other contaminants associated with the World Trade Center that were not included in the COPC document or the Confirmation Cleaning Study that may serve as a surrogate for determining the risk from other contaminants?

On March 17, 2004, ERG conducted a briefing call for the peer reviewers, during which EPA provided background information for and purpose of the review, and ERG provided information on deadlines and deliverables. Call participants are listed in Appendix B. Peer reviewers introduced themselves, described their areas of expertise, and asked questions to clarify the charge and the review process. During this conference call, reviewers mentioned the treatment of overloaded samples for which asbestos sampling was not possible. When samples were overloaded such that asbestos measurement was not possible, EPA did not "clear" the apartment and offered a recleaning (or an initial cleaning, if the owner wanted a test only) of the apartment. Therefore, recleaning was offered in two circumstances: when an asbestos measurement was above the health-based benchmark and when a measurement was overloaded. Because EPA felt it was important that reviewers should review the entire protocol and the decision to use asbestos as a surrogate, EPA amended the first charge question slightly to read (change shown in bold):

Q1. Do the data in the Confirmation Cleaning Study, and any other data or findings, support the selection of asbestos in air as an appropriate surrogate, **in the manner used by Region 2 in their cleanup study**, for determining the risk from other contaminants?

After the March 17, 2004, kickoff call, reviewers individually addressed the charge questions, referring to the background documents, and prepared written comments addressing each of the three charge questions. Reviewers then submitted their written comments to ERG. (Appendix C contains copies of the reviewers' written comments.) Upon receipt, ERG distributed copies of the written comments to each of the reviewers and EPA. The reviewers were asked to read through each other's written comments in preparation for a conference call to discuss whether or not asbestos was an appropriate surrogate for determining risk from other WTC contaminants.

The peer reviewers and ERG participated in a two-hour conference call on April 8, 2004. ERG invited EPA to listen to the call for the purpose of providing any technical clarifications that might be needed to move discussions forward. Call participants are listed in Appendix B. The call was organized by ERG and facilitated by Dr. Annette Guiseppi-Elie. During this call, reviewers addressed the three charge questions and provided general comments regarding additional concerns for EPA's consideration. EPA provided clarifications only and did not participate in the discussions. Section 2 of this report summarizes the peer review conference call discussions and written comments.

2. Reviewer Evaluation of Asbestos as a Surrogate

This section summarizes issues and concerns raised by the peer reviewers during the conference call and in their written comments. (Specific format and typographical comments are not listed in this summary report, but are included in the written comments in Appendix C.)

During the conference call, EPA's National Center for Environmental Assessment (NCEA) and EPA Region 2 provided clarifying remarks to address questions raised in the written comments, the peer reviewers addressed the three charge questions, and the peer reviewers provided general comments regarding additional concerns for EPA's consideration. Reviewers addressed each of the three charge questions in sequence. Comments beyond the scope of the three charge questions were addressed at the conclusion of the call.

2.1 EPA NCEA and Region 2 Clarifying Remarks

Prior to the conference call, each of the peer reviewers and EPA read the written comments. In reading these comments, EPA noted that several questions raised by the peer reviewers could be addressed by providing additional information. As such, EPA provided the following clarifying remarks at the beginning of the conference call:

- *Peer Review Purpose:* EPA commended the peer reviewers for the depth and detail included in their written comments. EPA hoped that, during the call, the reviewers could provide more information about how they reached conclusions or address how their views might have changed as a result of speaking with the other experts on the call. EPA emphasized that the reviewers did not need to reach a conclusion or single answer to the charge questions. EPA, however, would like the reviewers to provide recommendations related to using a surrogate to determine risk for other WTC dust contaminants.

- *Peer Review Role in WTC Efforts:* This peer review was conducted to solely address the question of whether or not asbestos is a good surrogate for determining risk and is only one part of a larger effort to assess WTC dust contamination. Results of this peer review will provide additional information that may inform other EPA efforts and the larger WTC expert technical panel reviews of this topic, as well as sampling plans and sampling results.

- *Confirmation Cleaning Study Results:* One peer reviewer was specifically concerned about a lead sample collected during the Confirmation Cleaning Study and labeled as rejected by the analytical laboratory. EPA Region 2 indicated that this sample was rejected because lead was also detected in the laboratory blank, indicating laboratory contamination. Laboratory contamination causes results to inaccurately report elevated contaminant levels. Regardless, EPA Region 2 considered the lead sample as valid and used this result as the basis to re-clean the apartment from which the sample was collected.

- *Analytical Methods:* EPA Region 2 provided clarification regarding the sampling methods used during the Confirmation Cleaning Study. Cleaning and sampling were conducted as an iterative process. Samples were collected before and after cleaning (pre- and post-cleaning samples). If the post-cleaning samples contained elevated levels of contaminants, another round of cleaning occurred. EPA Region 2 continued to clean and conduct post-cleaning sampling until samples reported contaminant levels below the derived risk-based benchmarks. Similar cleaning and analytical methods were used in the apartments and common areas.

- *Additional Sampling.* The written comments provided by one reviewer implied that EPA would be sampling for additional contaminants during an upcoming re-sampling effort. EPA indicated that the currently planned resampling effort will include asbestos only; no additional contaminants are being considered for this new re-sampling effort.

2.2 Review of Charge Questions

During the April 8, 2004, conference call and in their pre-call written comments, reviewers discussed each of the three charge questions in sequence. Guiseppi-Elie began the discussion for individual charge questions with a summary of the written comments, noting areas of agreement and disagreement. Reviewers then provided additional information to support their comments, asked others about the reasoning behind a comment, and raised specific concerns for discussion. Once reviewers felt that all aspects of the charge question had been addressed, Guiseppi-Elie summarized discussions, noting any changes in conclusions and areas of agreement or disagreement. A summary of the question-specific discussions is provided below.

Q1. Do the data in the Confirmation Cleaning Study, and any other data or findings, support the selection of asbestos in air as an appropriate surrogate, in the manner used by Region 2 in their cleanup study, for determining the risk from other contaminants?

In the written comments, one reviewer determined that asbestos was an appropriate surrogate and another concluded that asbestos was not. The remaining reviewers provided qualified answers to this question, such as asbestos would be an appropriate surrogate if EPA included validation sampling.

Dr. Gary Ginsberg began discussions by providing additional information supporting his conclusion that asbestos sampling alone would not be an appropriate surrogate for determining risk from other contaminants. He conducted a detailed review of the data set provided in the Confirmation Cleaning Study and felt that the data set did not provide him with the level of confidence that he would have liked for drawing conclusions. Regardless, Ginsberg reviewed the data available in the report and appendices, focusing on the test method for using asbestos as a surrogate rather than focusing on whether or not cleanup had been achieved. He noted that lead would drive additional cleaning for approximately 30 percent of the samples collected, indicating that sampling for asbestos alone would not capture concentrations of WTC COPCs that exceeded their risk-based benchmarks. No other COPCs, except one isolated sample with

elevated silica alone, were noted as exceeding their benchmarks when both asbestos and lead concentrations were below benchmarks, indicating no further cleaning was necessary. Ginsberg concluded that asbestos sampling alone is a good starting point for assessing cleanup and recontamination, but he recommended adding lead wipe sampling.

Dr. R.P. Nolan concluded that asbestos alone would serve as an appropriate surrogate for determining risk from other WTC COPCs. Unlike the other reviewers, he gave less weight to the lead wipe sample results because the study building on Liberty Street is more than 100 years old, and background lead levels in the building were ambiguous. Discerning lead from the WTC and lead from background sources would be difficult. Nolan also indicated that he had general concerns about wipe samples as a test method. He felt that the cleaning method applied was appropriate and would address the WTC COPCs. Nolan indicated that selecting asbestos alone or asbestos with lead sampling as a surrogate was less important than ensuring that the cleaning methods were appropriate and effective.

Mr. John Kominsky indicated that he reviewed EPA data generated at the Liberty Street building and also data collected at another WTC building. These data are confidential, hence, he was unable to provide the data to the other reviewers. He also reviewed data from an unrelated collapse of a five-story school building. Based on data from these sources, Kominsky concluded that asbestos would serve as an appropriate surrogate for determining risk from other WTC COPCs. In his written comments, Kominsky did not recommend additional sampling for lead because of a concern about background levels and confounding sources of lead. Lead was also consistently present in the other data sets he reviewed. During the conference call, he agreed to support a recommendation for lead surficial sampling as a supplemental surrogate to asbestos. Kominsky also expressed concern regarding the sampling method employed by EPA and the possibility of “false negative” results. Reviewers discussed this concern in detail, as summarized in Section 2.3 of this report.

Dr. Clifford Weisel felt that asbestos air sampling was a good starting point for determining risk from other WTC COPCs. In his written comments, however, Weisel expressed concern that the Confirmation Cleaning Study focused on a limited number of apartments in a single building. He was concerned that asbestos was not used throughout the WTC towers and that WTC dust samples have reported non-detect levels to 1 to 2 percent asbestos. He questioned the potential distribution and presence of asbestos in the dust generated during the WTC tower collapse. If only found in a portion of the WTC dust, then asbestos alone would not serve as an appropriate surrogate. Kominsky stated that the data he reviewed reported asbestos in most settled dust samples. With that information, Weisel was more comfortable with the use of asbestos as a surrogate, but he also indicated that inhalation exposures were not his primary concern. He was more concerned about surface exposures to the other WTC COPCs. He agreed with Ginsberg and others that adding lead wipe sampling as a supplemental surrogate to asbestos air sampling would address this concern.

Guiseppi-Elie suggested conducting asbestos air sampling, in combination with validation sampling for the other WTC COPCs, as appropriate for determining risk. That is, she encouraged EPA to continue to monitor some percentage of samples for COPCs beyond asbestos for

continued verification of the appropriateness of the sampling and cleanup strategy. She questioned if adding lead wipe sampling would be appropriate if EPA conducted pre-filtering during sampling to prevent overloading samples. Ginsberg responded that EPA had no plans to add pre-filtering as part of the sampling protocol. As such, Guiseppi-Elie agreed that lead wipe sampling in addition to asbestos air sampling would be an appropriate surrogate.

Q2. Do other contaminants that were measured in the Confirmation Cleaning Study provide equally good or better surrogates for determining the risk from other contaminants?

After discussions conducted to address the first charge question, each of the reviewers agreed that adding lead wipe sampling in addition to asbestos air sampling would provide a better estimate of risk from other WTC COPCs. If EPA were limited to sampling for only a single COPC, reviewers agreed that none of the other COPCs would be better surrogates than asbestos. Nolan indicated that he originally excluded lead wipe sampling because of his concern about background lead concentrations confounding results. He felt that because the WTC tower collapse was a seismic event, lead would have been released from sources within surrounding buildings rather than from the WTC dust itself. Ginsberg expressed the same concern about background contributions of lead. He assumed, however, that lead from background sources (e.g., peeling paint or chalking from windows) would be minimal in the confirmation cleaning sampling because of the short time between cleaning and resampling and the lack of building occupation during that time. Weisel stated, and others agreed, that cleaning the lead regardless of the source would be a prudent public health action because of the known effects of lead exposures in young children.

Q3. Do the reviewers know of any other contaminants associated with the WTC that were not included in the COPC document or the Confirmation Cleaning Study that may serve as a surrogate for determining the risk from other contaminants?

In his written comments, Weisel mentioned glass fibers produced from the shattering and grinding of the WTC tower collapse as another contaminant that might be a better surrogate than asbestos. He suggested glass fiber sampling to address his concern that asbestos would not be distributed throughout the WTC dust. Kominsky provided information during the conference call that addressed Weisel's concern. Kominsky indicated that asbestos was reported in most settled dust samples that he had reviewed. Each of the five reviewers concluded that they knew of no other contaminants associated with the WTC that were not included in the COPC document or the Confirmation Cleaning Study that would served as an appropriate surrogate for determining risk.

2.3 Additional Comments

As the reviewers addressed the three charge questions in their written comments and discussed the questions during the April 8, 2004, conference call, they also raised concerns or made comments on several issues beyond the scope of the charge questions.

- *Hand Transfer Values:* For completeness, Ginsberg reviewed the risk targets selected by EPA for developing the risk-based benchmarks. He indicated that he was comfortable with the selected risk targets. He felt, however, that the hand transfer values from a surface to a hand, specifically for young children, held much uncertainty. EPA selected a dry hand transfer value, whereas children who may be crawling on the floor would likely have moist or damp hands. As such, a wet transfer value, which assumes a greater transfer of dust to a hand, would provide a more conservative (protective) risk-based benchmark. To address this concern, Ginsberg recommended that EPA reconsider the selection of dry versus wet hand transfer values, provide additional information explaining why the dry hand transfer values were selected, or perhaps investigate using wet hand transfer values within a set boundary.

- *Asbestos Sampling Methods:* Reviewers discussed three concerns about the asbestos sampling methods employed by EPA.

  Kominsky reviewed sampling data sets for the Liberty Street building, another WTC building (confidential), and an unrelated five-story school building collapse. Kominsky's recent experience in conducting air sampling for asbestos using a modified aggressive technique (i.e., air sweeping floors and stationary fans operating at 1 fan per 1,000 square feet) showed that air sampling alone resulted in "false negatives" for residual surface contamination. That is, no asbestos structures (>0.5 μm and > 5 μm) were detected in the air samples analyzed using transmission electron microscopy (method AHERA 40 CFR 763, enhanced protocol). Analysis of surface wipe samples, however, detected asbestos fibers (method ASTM Method D 6480-99). The highest asbestos concentrations in surface wipe samples were found on elevated, horizontal surfaces, such as the top of a bookcase. Hence, asbestos fibers would be less likely to be re-entrained by the modified aggressive sampling technique. He suggested that EPA consider adding asbestos surface sampling to confirm cleanup. Kominsky and the other reviewers noted that use of best engineering judgment would be necessary when selecting surface sample locations. Nolan noted that the information Kominsky presented regarding false negatives was based on confidential data not available to the other reviewers. In Nolan's experience, surface asbestos concentrations do not necessarily reflect elevated airborne asbestos concentrations, which are the basis for asbestos benchmarks and cancer concerns. He was satisfied that the aggressive and modified aggressive sampling protocols used by EPA were acceptable for clearing an apartment as clean.

  Reviewers also noted that the sampling method for re-entraining the asbestos fibers also did not consider contaminants that may be present in a building's heating, ventilating, and air conditioning (HVAC) system, which distributes indoor air through duct work. Kominsky recommended that the HVAC system serving an apartment operate with its fan running for 72 hours before air and surface sampling is conducted. He also noted that EPA developed a risk-based benchmark for asbestos in surface samples. As such, EPA could add asbestos surface sampling in the HVAC system to assess potential re-contamination concerns.

Reviewers noted that EPA allowed people participating in a voluntary cleanup program to select an aggressive or modified aggressive sampling method for their apartments. Weisel stated, and the other reviewers agreed, that EPA should select only one sampling method that is reviewed to confirm that the method is appropriate for drawing conclusions about the need for additional cleaning. Using only one sampling method would provide consistency across the cleanup effort.

- *Hospital Record Review:* In his written comments, Nolan questioned if EPA had reviewed hospital records or mortality data after the WTC disaster. During the conference call, Nolan said that reviewing hospital records and mortality data may provide some interesting and useful information, such as identifying elevated blood lead levels. Ginsberg indicated that many confounding factors are associated with elevated blood lead that the impacts from the WTC disaster would be difficult to assess. Reviewers, however, agreed that EPA should consider reviewing hospital records and mortality data as a source of additional useful information about the impacts of the WTC disaster.

2.4 Conclusions and Recommendations

Overall the reviewers concluded the following:

Q1. Asbestos air sampling methods in the manner conducted by EPA would serve as a reasonable—but not stand-alone—surrogate for determining the risk from other contaminants if EPA also conducted lead wipe sampling. Adding the lead wipe samples would address the reviewers' concerns about data points from the Confirmation Cleaning Study that reported elevated lead in wipe samples without elevated asbestos air samples.

Q2. None of the other contaminants selected as WTC COPCs would serve as an equally good or better surrogate than asbestos if EPA decided to sample for only a single contaminant to confirm cleanup. Again, reviewers noted that asbestos sampling results would be strengthened with the addition of lead wipe samples.

Q3. Reviewers identified no other contaminants associated with the WTC that were omitted from the COPC selection document or the Confirmation Cleaning Study and would serve as a surrogate for determining risk.

In addition to answering the charge questions, reviewers offered the following recommendations based on their discussions:

- Conduct lead wipe sampling in addition to asbestos air sampling to confirm cleanup.

- Review sampling and cleaning methods to prevent "false negatives" and use only one sampling method (aggressive versus modified aggressive).

- Address potential re-contamination by running an apartment's HVAC system before sampling and conducting surface and air asbestos sampling.

- Consider revisiting the dry hand versus wet hand transfer factors when estimating risks for children (perhaps bounding the wet hand transfer values) or provide a more in-depth discussion supporting the selection of the dry hand transfer values.

- Consider reviewing hospital records to identify potential anomalies.

2.5 Schedule for Revisions

At the conclusion of the April 8, 2004, conference call, ERG summarized the upcoming schedule for this peer review. ERG committed to providing the peer reviewers and EPA with an electronic copy of a draft report summarizing the peer reviewers' written comments and conference call discussions by April 15, 2004. Each reviewer will be asked to review the draft report for accuracy and completeness and submit comments to ERG by April 22, 2004. ERG will review and incorporate comments, seeking clarification as needed, to finalize the report.

Appendix A: Charge to Reviewers

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MARCH 15, 2004

OFFICE OF RESEARCH AND DEVELOPMENT

MEMORANDUM

SUBJECT: Charge For World Trade Center Peer Consultants

FROM: Paul Gilman, Assistant Administrator
Office of Research and Development

TO: Peer Reviewers

Thank you for your assistance in providing comment regarding difficult issues EPA is now tackling as it prepares to undertake a program to resample residential apartments near the World Trade Center. As you will see in the background section below, EPA will shortly be undertaking a limited resampling of residential apartments near the World Trade to ascertain whether they have become recontaminated over time with World Trade Center contaminants. A key question that needs to be answered as that sampling plan is developed is whether asbestos is a good surrogate contaminant for evaluating the risk from all World Trade Center contaminants.

The background section that now follows provides the basis for the charge questions that will be posed.

Background

The collapse of the World Trade Center towers resulted in the incursion of contaminants to the indoor environment, including residences, business offices, stores, and other commercial areas near Ground Zero. While the clean-up at Ground Zero itself was occurring, public pressure began to mount for EPA to also address the cleanliness of the indoor environment. Planning for a program to clean residential apartments began in March of 2002. This planning and all activities associated with the apartment clean-up occurred on several concurrent tracks. One track focused on identifying WTC contaminants of potential concern and developing health-based benchmarks associated with indoor residential exposure. A second track was to evaluate the effectiveness of the chosen cleaning methods by conducting before and after cleaning sampling on a limited number of impacted apartments. The third track, of course, was the actual residential clean-up program itself.

These “contaminants of potential concern”, or COPCs, were determined to be lead, polycyclic aromatic hydrocarbons (PAHs), asbestos, dioxin, fibrous glass, and crystalline silica. Employing toxicological information along with exposure assumptions in a scenario-based assessment approach, EPA’s Region 2 developed risk-based benchmark concentrations for these COPCs. One of these benchmarks, for example, was an asbestos air concentration benchmark of 0.0009 f/cc. This was developed using the IRIS unit inhalation cancer risk factor 0.23 (1/[f/cc]) for asbestos, and a “clearance criteria” of 10^{-4} for lifetime excess cancer risk due to inhalation. In other words, if air concentrations were found to be less than 0.0009 f/cc of asbestos, an apartment could be considered cleared because an estimated lifetime cancer risk would be less than 10^{-4} if air concentrations were below this concentration for an expected time of residence within these apartments of 30 years. Similar criteria were developed for the other airborne contaminants as well as for contaminants sorbed to settled dust. These benchmarks were being developed during the spring and summer of 2002, and in October of 2002, an external peer review panel met in New York City to review the document on these benchmarks, which was titled, *World Trade Center Indoor Air Assessment and Selection of Contaminants of Concern and Setting Health-Based Benchmarks*. The final document, which addressed the panel’s comments, was completed by the Region in May of 2003.

A second effort focused on evaluating the efficacy of the cleaning and vacuuming methods that were to be employed by the Region in their clean-up program. The Region selected a heavily impacted building on Liberty Street, just south of Ground Zero, to conduct the study. The “Confirmation Cleaning Study” began cleaning and testing apartments on June 12, 2002. A total of 13 apartments and 5 commercial areas in this building were tested before and then again after cleaning. Various clean-up methods, including the ones used in the volunteer residential clean-up program, were evaluated in this study. Baseline air and dust samples were collected at targeted locations throughout the building. Pre-cleaning air samples were taken in 2 of the 13 apartments and in the 2 commercial areas, and post-cleaning air samples were taken in the 13 apartments and the 2 commercial spaces. Pre-cleaning wipe samples were taken in the 13 apartments and in 2 commercial areas, and post-cleaning wipe and air samples were taken in the 13 apartments and the 2 commercial spaces. The overall finding was that a combination of wet wiping and vacuuming was mostly sufficient to reduce levels of contaminants below the benchmark concentrations developed for the residential clean-up program. Based on an analysis of the results from this study, “The study found that conducting asbestos air sampling was a conservative method for determining if additional cleaning was required.” EPA Region 2 had the results of this study in late summer of 2002, and began drafting the report during the fall and winter of 2002. A draft of this study, titled *Interim Final WTC Residential Confirmation Cleaning Study*, was made available to the public in May of 2003.

In May 2002, EPA Region 2 announced the voluntary clean-up program to the public. Registration for this program began in July 2002 and officially ended on December 31 of 2002. The clean-ups began in September of 2002, and continued until about June of 2003. The “clean-up area” was an area of about 1 mile wide by 1 mile long below Canal St. It is estimated that there are about 2000 buildings in this area, of which 500-600 are residential structures. There are approximately 23,000 apartments in these buildings. The program cleaned and/or tested about 4,200 apartments in 480 buildings; 3,400 apartments were both cleaned and then tested after being cleaned, denoted "cleaned and tested", and 800 were "tested only". This "test"

involved agitation to resuspend any contaminants that may be on floor or other surfaces, and then taking an air sample and measuring for asbestos. The asbestos result was compared to the health based benchmark level of 0.0009 f/cc. An apartment was deemed "cleared" if the asbestos measurement was below this benchmark.

Of the approximately 4,200 apartments that were tested, 44 apartments, or about 1% of the total, showed an exceedence of the asbestos health benchmark of 0.0009 f/cc;. A total of 166 apartments, or about 4% of the total, were not cleared because of overloading on the filters or other problems with sampling or analysis. The percentage of apartments showing at least one exceedence when tested after cleaning (35 of 3,400 apartments) was essentially identical to the percentage of apartments showing exceedences who had asked for testing only (9 of 800 apartments). The percentage of apartments not cleared when tested after cleaning due to overloading (133 of 3,400 apartments or about 4%) was essentially identical to the percentage of apartments not cleared due to overloading who had asked for testing only (33 of 800 apartments or about 4%).

Details on all these three concurrent efforts are included in the noted documents and other materials that will be supplied to assist in providing answers to the charge questions below. It is important to emphasize that these efforts were concurrent, and that is why milestone dates were provided in the brief summaries above. Key decisions were made about the conduct of the volunteer clean-up program, such as the methods to be employed for clean-up, and the testing used to determine whether an apartment could be “cleared”, prior to the completion of the confirmation cleaning study and the review of the COPC document.

This review is being requested of you based on the result of interactions between the EPA, the White House Council on Environmental Quality, and Senators Clinton and Lieberman, during 2003. These interactions resulted in agreements which were outlined in a letter from James Connaughton, Council on Environmental Quality, to Senators Clinton and Lieberman, dated October 27, 2003 This letter outlined the following:

> “To provide greater collaboration in ongoing efforts to monitor the situation for New York residents and workers, and assure them of their current safety, we will be undertaking the following activities: 1) extend the health follow-up associated with the Agency for Toxic Substances and Disease Registry’s (ATSDR) registry of residents and workers; and 2) convene an expert technical review panel to help guide the agency’s use of the available exposure and health surveillance databases and registries to characterize any remaining exposures and risks, identify unmet public health needs, and recommend any steps to further minimize the risks associated with the aftermath of the World Trade Center attacks. EPA would organize and lead this group of experts, with representation from the federal agencies directly involved in the air quality response and monitoring, the New York City Departments of Health and Environmental Protection, and outside experts.
>
> The panel would review the following:
>
> <u>Within 3-6 months:</u>

Post cleaning verification sampling in the residential areas included in EPA's Indoor Air Cleanup to verify re-contamination not has occurred from central heating and air conditioning systems;

The peer reviewed *"World Trade Center Indoor Air Assessment and Selection of Contaminants of Concern and Setting Health-Based Benchmarks,"* which concluded asbestos was an appropriate surrogate in determining risk for other contaminants.

Within 18-24 months:

Identification of any areas where the health registry could be enhanced to allow better tracking of post-exposure risks by workers and residents.

Review and synthesize the ongoing work by the federal, state and local governments and private entities to determine the characteristics of the WTC plume and where it was dispersed, including the geographic extent of EPA and other entities monitoring and testing, and recommend any additional evaluations for consideration by EPA and other public agencies."

This review is specifically being initiated to provide assistance to the expert technical panel which is identified in the above quote, and more specifically, to provide expert opinion on the question of whether asbestos was an appropriate surrogate in determining risk for other contaminants. This is a key question that has to be addressed prior to undertaking the post-cleaning verification sampling program that is described above.

Charge to the Reviewers

From the background section above, it should be clear that the cited document in the letter, *World Trade Center Indoor Air Assessment and Selection of Contaminants of Concern and Setting Health-Based Benchmarks*, was not the document which concluded that asbestos was an appropriate surrogate in determining risk for other contaminants. In fact, the conclusion as specifically cited from the Confirmation Cleaning Study, itself did not identify asbestos as the "appropriate surrogate in determining risk for other contaminants", but rather that, "asbestos air sampling was a conservative method for determining if additional cleaning was required". This was based on the finding that when asbestos air measurements could not be reliably analyzed due to overloaded filters or the results were found to be very low or not detected in post-cleaning sampling in this study, other contaminants were found to be low or not detected in both air and wipe tests. It can be inferred, therefore, that for WTC-related dust, asbestos might be a surrogate for determining risk from other contaminants - it has just never been stated as such in the Confirmation Cleaning Study, and certainly was not even addressed in the COPC document.

With that as a comment, the first charge question is:

1. The Confirmation Cleaning Study concluded that "asbestos air sampling was a conservative method for determining if additional cleaning was required." Given this conclusion and its supporting data in the Confirmation Cleaning Study and all other data sources, is the selection of asbestos as a surrogate *in the manner used by Region 2*[1] in their cleanup study, for determining the risk from other contaminants supported? Please provide a detailed response, explaining the reasoning for your yes or no answer.

Recognizing that the answer to that question may lead to other issues, the peer consultants are also being asked to provide answers to these questions:

2. Do other contaminants that were measured in the Confirmation Cleaning Study provide equally good or better surrogates for determining the risk from other contaminants? If yes, please describe in detail which contaminants you would consider and why. If no, provide justification for your response.

3. Do the reviewers know of any other contaminants associated with the World Trade Center that were not included in the COPC document or the Confirmation Cleaning Study that may serve as a surrogate for determining the risk from other contaminants? If so, please provide the details regarding these contaminants and the reasons why they should be considered. Provide citations for any references mentioned, and/or submit hard copies of the referenced documents.

Again, EPA thanks you for your assistance in providing expert comment on these issues.

---

1 On March 17, 2004, EPA amended the charge for clarification purposes.

Appendix B: Conference Call Participants

Peer Reviewers

Dr. Gary L. Ginsberg, Ph.D.
Dr. Annette Guiseppi-Elie, Ph.D.
John R. Kominsky, M.Sc., CIH, CSP, CHMM
Robert. P. Nolan, Ph.D.
Dr. Clifford P. Weisel, Ph.D.

U.S. Environmental Protection Agency (EPA)*

Matthew Lorber (EPA National Center for Environmental Assessment [NCEA], Task Order Project Officer)

Ray Klimscak (Region 2)
Chuck Nace (Region 2)
Dennis Santella (Region 2)

*EPA attended the April 8, 2004, call as observers, available for clarification, and did not participate in the peer review discussions.

Eastern Research Group, Inc. (ERG) Staff

Sarah Dun (April 8, 2004 only)
Kate Schalk

Appendix C: Individual Reviewer Written Comments

Gary L. Ginsberg, Ph.D.

March 29, 2004

**Comments on Proposed Surrogate Clearance Testing
for WTC-Related Contamination
Contract No. 68-C-02-060
Task Order No. 59**

Charge Question 1: The Confirmation Cleaning Study concluded that "asbestos air sampling was a conservative method for determining if additional cleaning was required." Given this conclusion and its supporting data in the Confirmation Cleaning Study and all other data sources, is the selection of asbestos as a surrogate for determining the risk from other contaminants supported? Please provide a detailed response, explaining the reasoning for your yes or no answer.

The selection of asbestos in air sampling, by itself, does **not** appear to be a sufficiently conservative surrogate test method. I have reached this conclusion by considering the following issues:

1. Does the existing sampling data at the pre-cleanup, interim cleanup, and post-cleanup stages support the notion that asbestos air sampling provides quantitative and qualitative results (needs cleanup vs. no cleanup needed) that are in step with what is found for the other key indicator analytes? ***Answer: Not necessarily.***

2. Are the cleanup criteria established for the key analytes appropriately risk-based so that any conclusion about a conservative testing surrogate has a firm underpinning in health protection? ***Answer: Yes, but one aspect of the equations (floor to skin transfer factor) appears to be particularly uncertain and should be reevaluated by USEPA.***

Issue 1

It would be ideal to have a robust dataset involving a large number of affected units in which the analyses have been completed for the full suite of WTC contaminants of potential concern (COPCs). This might foster regression or other type of analysis for the purpose of documenting the correlation across contaminants. This quantitative approach would be particularly important in documenting whether there are instances in which certain COPCs might be high in the absence of substantial asbestos air contamination.

While desirable, the data needed for correlational analysis is quite limited. In the WTC Confirmation Cleanup Study, only 12 residential units were tested and cleaned one or more times. The before cleanup testing might be considered the most robust data for correlational analysis because of the fewer number of non-detects. However, most of this pre-cleaning round is invalid for the purpose of the current question because asbestos wipe, rather than air sampling was conducted. It is noteworthy that there was some correspondence between asbestos wipe

results and the results for other wipe tests (lead, fiberglass) but this correlation was not completely consistent (Table 10 – Ranking of Residential units, Confirmation Cleaning Study). We don't know how the asbestos air sampling would have performed within this ranking framework and compared to these other analytes.

The post-cleanup sampling effort for the residential units in the Confirmation Cleanup Study did involve asbestos air testing in conjunction with tests for the other analytes. The greatest amount of data is available for the first post cleanup stage (13 units). As demonstrated in Table 12, 4 analytes (MMVF, alpha-quartz, dioxin, PAH) were below the cleanup target in most or all of the units after the first cleanup round. Two types of tests, asbestos in air and lead wipes, had a substantially higher failure rate, with this being most pronounced in the case of the asbestos results. This information, combined with the results from the second and third cleanup rounds, led the Confirmation Cleanup Study report to conclude that asbestos air sampling is a conservative testing approach.

Evaluation of the more detailed results presented in Table 11.2 (Exceedance Tables) for the residential units (summarized here in Table 1 below) demonstrates that there were no actual asbestos air exceedances in these residential samples, but that sample overload occurred in numerous locations, necessitating further cleanup. Glass fibers were elevated by a large margin in one case, which was also a case in which the asbestos sample was overloaded. The only other analyte to show elevations in this round of residential testing was lead, with generally small elevations over the cleanup target. These lead elevations occurred in the presence of asbestos filter overload in 2 instances, and significantly there were 2 instances (Units 5A and 4D) where the lead exceedance occurred in the absence of an asbestos exceedance or overload. It should be noted that for some reason, the lead result for Unit 4D was rejected. However, that still leaves unit 5A with a lead wipe exceedance in conjunction with an asbestos air result that met the criterion.

Table 1
Summary of Post-First Cleanup Exceedance Results in
Residential Units from Liberty St
(Abstracted from Table 11.2; Expressed as Fold Increase above Target)

Unit #	Asbestos Air	Dioxin	PAH	MMVF	Silica	Lead Wipe
4A	---[a]	---[a]	---[a]	---[a]	---[a]	---[a]
5C	Overload	---[a]	---[a]	1600x	---[a]	---[a]
5A	---[a]	---[a]	---[a]	---[a]	---[a]	1.66
4D	---[a]	---[a]	---[a]	---[a]	---[a]	1.12[b]
4C	---[a]	---[a]	---[a]	---[a]	---[a]	---[a]
4B	---[a]	---[a]	---[a]	---[a]	---[a]	---[a]
4A	Overload	---[a]	---[a]	---[a]	---[a]	---[a]
3D	Overload	---[a]	---[a]	---[a]	---[a]	---[a]
3C	Overload	---[a]	---[a]	---[a]	---[a]	1.08
3B	Overload	---[a]	---[a]	---[a]	---[a]	2.06

Unit #	Asbestos Air	Dioxin	PAH	MMVF	Silica	Lead Wipe
3A	Overload	---[a]	---[a]	---[a]	---[a]	---[a]
2B	---[a]	---[a]	---[a]	---[a]	---[a]	---[a]
2A	Overload	---[a]	---[a]	---[a]	---[a]	---[a]

[a]Sampled but no exceedance.
[b]Result reported but rejected.

The commercial units and common areas at the Liberty Street site were tested for the above analytes, including asbestos in air, both before and after cleanup. These results were not included in Tables 12 or 14 of the Confirmation Cleaning Study, which are the key tables being put forward to support asbestos air sampling as an acceptable surrogate test method. Table 2 below summarizes the commercial/common area results.

Table 2
Exceedances at Non-Residential Locations in Liberty Street Building
(Abstracted from Table 11.2, Exceedances shown as fold increase above cleanup target)

Location	Test Round	Asbestos Air[a]	Dioxin	PAH	MMVF	Silica	Lead Wipe
Chiropractor	Pre-cleanup	---[b]	---[c]	---[c]	---[c]	---[c]	9.7
	Post – Test A	Overload	---[c]	---[c]	---[c]	---[c]	4.2
	Post – Test B	Overload/43	---[c]	---[c]	3900	---[c]	14
	Post – Test C	Overload/3.7	---[c]	---[c]	---[c]	---[c]	---[c]
	Post – Test D	---[c]	---[c]	---[c]	---[c]	---[c]	---[c]
	Post – Test E	---[c]	---[c]	---[c]	---[c]	---[c]	38
Barber Shop	Pre-water wipe	---[c]	---[c]	---[c]	---[c]	---[c]	1.7
Mattress Store	Pre-cleaning	Overload	---[c]	14	5700	---[c]	2.3
	Post-Test A	Overload	---[c]	---[c]	---[c]	---[c]	1.7
	Post-Test B	Overload	---[c]	---[c]	---[c]	---[c]	3.4
	Post-Test C	2.2	---[c]	---[c]	---[c]	---[c]	---[c]
	Post-Test D	---[c]	---[c]	---[c]	---[c]	---[c]	---[c]
	Post-Test E	---[c]	---[c]	---[c]	---[c]	---[c]	1.5
Liberty St Staircase	Post-1st Cleaning	---[c]	---[c]	---[c]	---[c]	5.5	---[c]
LemonGrass	Post-1stcleaning	Overload	---[c]	---[c]	---[c]	---[c]	6.6
LemonGrass Basement	Post 1stcleaning	---[c]	---[c]	---[c]	---[c]	---[c]	---[c]
FoodExchan	Post	---[c]	---[c]	---[c]	---[c]	---[c]	6.4

Location	Test Round	Asbestos Air[a]	Dioxin	PAH	MMVF	Silica	Lead Wipe
ge	1st cleaning						
5th Floor Hall	Post 1st cleaning	Overload	---[c]	---[c]	---[c]	---[c]	---[c]

[a]PCMe test results.
[b]PCMe testing was below target, but screening asbestos air test via PCM did show an elevation in one of two samples.
[c]Sampled but no exceedance.

These results show 9 asbestos air samples with a numeric exceedance or filter overload, which is consistent with the residential unit sampling in that this method yielded the greatest number of results that triggered further cleanup. Importantly, there were no exceedances of the dioxin target and only one of the PAH target. While the PAH wipe sample exceedance was large, it occurred in a location that needed cleanup based also on the asbestos air result. A similar situation exists with the 2 exceedances seen for glass fibers: large exceedances but also occurring only where the asbestos in air result would trigger remediation anyway. A single exceedance for crystalline silica was found, that in the Liberty St. staircase, and this occurred in the absence of an asbestos or any other exceedance. The Confirmation Cleaning Study discounted this result because it was such a unique finding. The lead results indicate numerous exceedances. In 5 of the 11 lead exceedances, asbestos in air was not also elevated or overloaded. This is in contrast to the results for the residential units in which asbestos air samples were elevated or overloaded in nearly all cases where lead was elevated.

When combining the residential and non-residential sampling results for the Liberty Street building, one obtains elevated asbestos in air results in the majority (16 of the 23 or 70%) of the sampling events where exceedances were found. However, this is not as high a percentage as one would like when relying upon a surrogate test as an index of clearance from WTC-related contamination and public health protection.

In all cases except one, the analyte not in step with the asbestos in air results was lead. This may indicate that there are contributions to the measured lead levels in these residential and commercial spaces that are not related to fallout from the WTC. This would be most plausible if the building was built before 1978 and contains lead paint in disrepair. In this event, lead exceedances might occur even in spaces cleared of WTC contamination due to continued peeling of paint. However, I could not find mention of the construction date of the building or whether it contains lead paint, and if so, what was the condition of that paint. Further, the time frame between initial cleaning and retesting may be too short for significant lead recontamination from local painted surfaces, especially since the building was unoccupied during this time interval. Additional support for the concept that lead is primarily from WTC fallout rather than from local paint is the ranking data presented in Table 10 of the Confirmation Cleaning Study report. That table shows that when units were compared based upon their contamination rank score, that there was a generally good rank correlation between the asbestos wipe and lead wipe results (i.e., where lead was high, asbestos was high and vice versa). This would suggest that the primary source of both analytes is the same, presumably fallout from the WTC explosion.

The other possible reason for the lead-only exceedances is that there had been recontamination of surfaces with WTC-related material but that material had somehow become enriched in lead or lead was more readily detected in certain cases than asbestos in air. If these are the reasons for the lead-only exceedances, then it raises the concern that asbestos in air testing alone is inadequate to ascertain the continuing presence of WTC contamination of public health significance.

Other reports which contain asbestos in air via PCMe testing (the proposed surrogate method) and other analytes are generally consistent with what was described above for the Residential Confirmation Cleaning Study. The "World Trade Center Residential Dust Cleanup Program" draft final report dated March 2004 (prepared by USEPA, Region 2) describes a residential cleanup program throughout lower Manhattan. Pre-cleanup and post-cleanup surface wipe sampling in conjunction with asbestos in air sampling was available for a subset of 214 residential units. The report documents that while the cleanup procedure was able to reduce lead dust loading by a large factor, 3% of the samples coming from 5 units were still above the lead wipe cleanup target. In contrast, the asbestos PCMe results indicated a somewhat greater cleanup success with 99% of the samples meeting the asbestos in air target after one cleanup round. These data suggest that, once again, lead exceedances occurred in locations where the proposed surrogate test method, asbestos in air via PCMe analysis, did not reveal an exceedance or overload.

It is also important to note that the March 2004 report demonstrates that both pre-cleanup and post-cleanup testing for dioxin found dust wipe samples to be uniformly below the health-based benchmark of 2 ng/m^2. This is consistent with the Residential Confirmation Cleaning Study and with another report involving WTC contaminant sampling, the "Characterization of Particles Found in Apartments after Destruction of the World Trade Center" (Chatfield and Kominsky, Oct. 2001). This latter report describes an exploratory sampling effort in two lower Manhattan buildings soon after the WTC disaster. One of the buildings (South End Ave.) was particularly close to ground zero. The limited sampling found asbestos and lead to be elevated in this building but the dioxin/furan results failed to find levels above that which can be found in background locations.

Thus, in summary, the sampling data that I reviewed for this scope of work would suggest that asbestos in air and lead surface wipe testing are key indicators of WTC contamination of buildings. However, analytes such as dioxins, PAHs, other metals, silica, or glass fibers may not be as commonly elevated, particularly post-cleanup, and would not need to be included in new sampling programs.

Issue 2

The May 2003 reported titled "World Trade Center Indoor Environment Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks" was reviewed to determine the adequacy of the cleanup targets and whether the inclusion/exclusion of COPCs was done in a reasonable and health-protective manner.

The report provides extensive justification for the exclusion of a large array of analytes from the COPC list on the basis of the analytes being too volatile to remain in the air or settled dust for extended time periods, or being of minor quantitative importance in the particulate cloud emanating from the fires as measured in early air and dust sampling, or due to the lack of sufficient toxicity information. The final COPC list is well justified and does not appear to be missing any key analytes.

The established target of 1 in 10^4 cancer risk for individual carcinogens may appear to be underconservative given that this is really the upper end of what might be considered an acceptable risk range and does not take into account the addition of risk across carcinogens that may act on similar tissues. However, the 1 in 10^4 cancer risk target for dioxins, PAHs and asbestos, the 3 carcinogenic COPC analytes, is necessitated by: a) asbestos in air: achievable analytical detection limits and background ambient conditions; b) PAHs in dust: achievable detection limits; c) dioxins: background concentrations of dioxins in dust. The background data come largely from the WTC Background Study, USEPA, 2003, which was designed specifically to assess background concentrations of COPCs in a part of Manhattan unaffected by the WTC fires. These considerations indicate that the 1 in 10^4 cancer risk target is justified on practical grounds. It is also reasonably health protective. For example, with respect to PAHs, the cancer slope factor for benzo(a)pyrene was applied to the total PAH load which is conservative given that benzo(a)pyrene is at least 10 fold more potent than most of the other carcinogenic PAHs. A 10^{-4} risk target for the other analytes, asbestos and dioxins is still well below levels that have actually been demonstrated to cause cancer in animals or humans, and there are no known interactions between PAHs, dioxins and asbestos that would imply synergism.

The exposure equations describing transfer of WTC-contaminated dust from floors to skin utilized fraction transferred (FTSS, unitless) value of 10% from carpets and 50% from hard surfaces, which is based upon a relevant dataset involving hand press experiments assessing particle transfer to dry skin. However, transfer to moistened hands would be somewhat greater, which could be the more prevalent case for toddlers who have frequent hand-to-mouth activity. The data source for this estimate (Rodes, et al., 2001) did find higher fraction transfer onto moistened hands but USEPA judged these data to be less reliable and so used the dry hand data instead. This would be expected to have a limited impact on lifetime cancer risk given the brief period of time during which the moistened hand factor would be relevant. However, USEPA's proposed child-specific cancer risk guidelines acknowledges greater cancer potency during early life than in older children or adults. This creates the possibility that using dry hand data for fraction transferred could be underconservative for young children's cancer risk.

The transfer coefficient (TC) term represents the rate of skin contact with the floor. The value adopted of 1200 cm^2/hr for toddlers is well below the Office of Pesticide Program default of

6000 cm^2/hr because the OPP value is a high end estimate assuming minimal clothing protection and high activity levels. A backfitting method was used to estimate a value of 1200 cm^2/hr which depends upon other uncertain values (e.g., dust loading on floor surface, exposed skin surface area) and limited data on dust load per cm^2 skin in children. However, the assumed value for exposed skin surface area for young children of 5000 cm^2 (50% of surface area of 7-8 yr olds) is conservative enough to make it likely that dermal exposure to dust particles will not be underestimated.

Regarding dust ingestion, the transferable residue from floor to fingers is dependent upon the fraction transferred, which as described above, the default assumptions may be underconservative for moistened hands. Other features of this model would appear to be highly uncertain including the hand surface area assumed to be in contact with the mouth (3 fingers or 15cm2 for toddlers), frequency of hand to mouth events (9.5/hr, 12 hr/d) and saliva extraction factor (50% assumed). While it is conceivable that the surface area in contact with the mouth could be an underestimate for some children, especially considering the ingestion of particles from the mouthing of toys as well, the other parameters, frequency of hand to mouth events and saliva extraction factor would appear to be conservative and counter-balance the possible underconservatism in the hand surface area.

Overall, risks associated with the dust exposure pathway would appear to be an uncertain calculation. When confronted with such uncertainty, risk assessments typically use high end bounding assumptions so as to not underestimate what the true exposure/risk might be. In the WTC cleanup criteria calculations for surface dust, it would appear that the assumption of dry hands might be an important underconservatism, especially since toddlers are assumed to play on carpeting the majority of the time and carpeting only had a 10% surface to skin transfer assumption. Thus, there is considerable room for increase in this assumption if warranted, based upon a closer inspection of the data from Rodes, et al., 2001. Thus, I recommend that this issue be revisited by USEPA, with the use of the dry hands data either further justified or the implications of using the moistened hand data on cleanup criteria explored. This issue should also be considered with regards to the lead in dust wipe cleanup target of 25 ug/ft^2 as it was in part, justified by assessing children's floor dust lead exposure and blood lead impact using the IEUBK model. Aside from the issue of dry vs. moistened skin uptake of dust, I consider the derivation of cleanup criteria for asbestos in air and COPCs in dust wipe samples to be generally adequate to protect public health at the designated risk target (10^{-4} or HI=1).

Charge Question #2: Do other contaminants that were measured in the Confirmation Cleaning Study provide equally good or better surrogates for determining the risk from other contaminants? If yes, please describe in detail which contaminants you would consider and why. If no, provide justification for your response.

As described above in tables and text, the asbestos in air (PCMe) technique did not always cover exceedances for other COPCs, particularly with respect to lead dust wipe results. While lead dust wipes should not be considered as a replacement for asbestos in air, I think the data point to the need for two surrogates (asbestos in air, lead dust wipe) to be run in tandem. If the lead dust wipe is the only analyte that is elevated, then other factors such as the presence of lead paint in the unit, condition of the paint and lead dust levels outside the unit (hallway and street dust),

may need to be taken into consideration to determine if the lead hazard stems from WTC or other sources, and whether re-cleaning this single apartment would lead to meeting the health-based criterion over the long term.

Charge Question #3: Do the reviewers know of any other contaminants associated with the World Trade Center that were not included I the COPC document or the Confirmation Cleaning Study that may serve as a surrogate for determining the risk from other contaminants? If so, please provide the details regarding these contaminants and the reasons why they should be considered. Provide citations for any references mentioned, and or submit hard copies of the referenced documents.

I do not know of any other candidate compounds to use as a cleanup test surrogate. The COPC screening process was thorough and well justified, with the test results pointing to asbestos in air and lead wipe testing as indicative of the need to reclean residential or commercial spaces.

NOTE: All documents cited in this review are either USEPA documents directly related to the WTC project or are cited within such documents. Since I have not cited any new publications, I have not included a bibliography or attached hard copy.

Annette Guiseppi-Elie, Ph.D

Review of World Trade Center Cleanup Confirmation Sampling "Strategy"
Reviewer: Guiseppi-Elie

Charge to the Reviewers

From the background section above, it should be clear that the cited document in the letter, *World Trade Center Indoor Air Assessment and Selection of Contaminants of Concern and Setting Health-Based Benchmarks*, was not the document which concluded that asbestos was an appropriate surrogate in determining risk for other contaminants. In fact, the conclusion as specifically cited from the Confirmation Cleaning Study, itself did not identify asbestos as the 'appropriate surrogate in determining risk for other contaminants', but rather that, 'asbestos air sampling was a conservative method for determining if additional cleaning was required.'

This was based on the finding that when asbestos air measurements could not be reliably analyzed due to overloaded filters or the results were found to be very low or not detected in post-cleaning sampling in this study, other contaminants were found to be low or not detected in both air and wipe tests. It can be inferred, therefore, that for WTC-related dust, asbestos might be a surrogate for determining risk from other contaminants - it has just never been stated as such in the Confirmation Cleaning Study, and certainly was not even addressed in the COPC document.

With that as a comment, the first charge question is:

1. The Confirmation Cleaning Study concluded, "asbestos air sampling was a conservative method for determining if additional cleaning was required". Given this conclusion and its supporting data in the Confirmation Cleaning Study, and all other data sources, is the selection of asbestos as a surrogate for determining the risk from other contaminants in the manner used by EPA supported? Please provide a detailed response, explaining the reasoning behind your yes or no response."

   Specifically, EPA conducted what they termed a "modified aggressive" asbestos air sampling method and they deemed the apartment "cleared" unless two conditions occurred: 1) the filter was "overloaded" such that a reliable asbestos measurement could not be made, or 2) a reliable measurement could be made and the concentration was greater than or equal to the health-based benchmark of 0.0009 f/cc. An apartment was "cleared" if an asbestos measurement could be reliably made and the result was a non-detect or a detect below the health benchmark. If an apartment was not "cleared" a re-cleaning was offered and accepted in most cases. "In the manner used by EPA" does not translate to sampling for asbestos in either (or both) dust and air, but only in air.

   Response: Based on a review of the all of the information provided, I would concur with the statement "asbestos air sampling was a conservative method for determining if additional cleaning was required". Specifically, the Interim Final WTC Residential

Confirmation Cleaning Study provides a reasonable logical approach to evaluating cleaning methods and sampling strategies that reached this conclusion.

The need for a surrogate is important because of the magnitude of the effort. In addition, the use of a "risk" driver constituent is appropriate to develop the surrogate.

The key components of the evaluation included:

- Selection of chemicals of potential concern (COPC)
- Development of health-based screening benchmarks
- Sampling buildings for these COPCs in appropriate media (before and after cleaning)
- Evaluation of results

The initial steps of determining an appropriate surrogate were the selection of COPCs and the development of their associated health-based screening benchmarks. These steps are critical in determining which constituents are likely to present the most significant potential risk. In these steps, a combination of both the toxicity and potential exposure are considered to determine potential risks. Although a number of constituents were detected in the WTC "dusts", an evaluation based on this risk potential (that is, using a combination of the number of times detected, the maximum detected and toxicity characteristics) appropriately narrowed the list to a manageable few. From these few, subsequent evaluation in the form of the sampling and analysis appears to have defined the relevant constituents. See below for additional discussion on selection of COPCs and the development of the associated health-based screening benchmarks.

Subsequent steps involved cleaning of some buildings and evaluating the effectiveness of the cleaning by sampling for the various COPCs identified. Findings (paraphrased) from this assessment are evaluated as follows:

- There was a pre-cleaning difference in the levels of contamination among units in the building.

  The data appears to support this conclusion.

- The observation of WTC dust is an indicator that WTC contaminants may be present. Amount of dust correlates with the level of contamination

  This finding is consistent with the results.

- Portions of the building with higher deposited WTC dust had higher levels of contamination.

  Again, this finding appears consistent with the data.

- Concentrations of some contaminants in the WTC dust were elevated above health-based benchmarks

This is an accurate assessment

- The use of standard cleaning methods significantly reduced levels of WTC-related constituents with each cleaning event. However, 2-3 cleanings were sometimes needed to reduce the levels to below health-based benchmarks. Number of cleanings tended to correlate with the initial contaminant levels.

  This finding is not unexpected. However, in light of this finding it is important for the sampling (and cleaning methods) to be consistently applied. Also, some measure of ongoing validation of the sampling strategy should be in place. It is my understanding that EPA will continue to for other COPCs, specifically metals and dioxins and other media including settled dust. I agree that this is appropriate.

- Conducting asbestos in air sampling after cleaning could be used as a surrogate method for determining if future cleaning was needed.

  This is a critical finding for the determination that "asbestos air sampling was a conservative method for determining if additional cleaning was required". It would appear that the conclusion is based on the fact that air sampling results for asbestos was by far the most frequent cause for re-cleaning (82% versus 27% for the next highest cause, that from lead). In addition, it was found that cleaning was sometimes required because of the sampling technique (excess particulate matter) rather than a health-based exceedance. This finding would appear to present a compelling rationale for the use of this type of monitoring, especially in response to the low level of detections for other constituents that might be more toxic, e.g., dioxins, or more likely to be present, e.g., lead.

- EPA also found that the use of an Air Filtration Device during cleaning offered a slight advantage to reducing the potential for filter overloading.

  It would be useful for EPA to include these statistics in its evaluation of “Number of Additional Cleaning Events Required based on Sampling Method” (Table 14 of the Confirmation Cleaning Report) to justify that "asbestos air sampling was a conservative method for determining if additional cleaning was required", regardless of the method used. Further, it would be wise for EPA to choose one set of conditions and apply these consistently, if this is not already being done.

- Finally, no measurable difference was found in the use of modified or aggressive air disturbance techniques.

  The data appears to support this finding. However, for consistency EPA should probably choose one of these techniques.

In summary, although a number of activities were performed simultaneously because of the nature of the incident, the end result suggest would suggest that the choice of COPC is supported by the Confirmation Cleanup Study. The use of asbestos appears to be a reasonable surrogate of risk (combination of toxicity and exposure potential) from the other COPCs. I would, however, encourage EPA to continue to monitor some percentage of samples for the other COPCs for continued validation of the strategy

2. **Do other contaminants that were measured in the Confirmation Cleaning Study provide equally good or better surrogates for determining the risk from other contaminants? If yes, please describe in detail which contaminants you would consider and why. If no, provide justification for your response.**

Response: In synchrony with the Confirmation Cleanup Study, EPA developed the Report for Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks. There were several issues raised by the Peer Review Panel of the original document. I believe that these issues have been adequately addressed in EPA's World Trade Center Indoor Environment Assessment: Response to Peer Review Comments on the Report for Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks (May, 2003).

One of the significant concerns identified with the original report was the narrowing of COPCs too early in the process. EPA's response specifically addresses this concern by evaluating a longer list of constituents including those raised by the Panel. The revised document has a logical and clearly articulated rationale for inclusion of specific constituents and not others. I am particularly pleased with the discussion of individual constituents that were identified by EPA as well as others.

The methodologies used for deriving the health-based criteria are typically well-defined EPA risk assessment guidance methodology and assumptions. Some assumptions may even be considered overly conservative for some media, e.g., exposure assumptions for dust.

In addition, I understand that EPA will continue to monitor for COPCs, although air sampling of asbestos will remain the driver. I agree that this is appropriate.

An issue raised in the Peer Review and in other documents suggests that 1×10^{-4} may not be an appropriate point of departure for determining the appropriate health-based benchmarks. I would offer that there are several EPA precedents that would suggest that risk levels "around" 10^{-4} are appropriate in some situations. I have attached a couple of documents to this end. The first is USEPA's Directive on the Role of Risk Assessment in Baseline Assessments (USEPA, 1991). Quote from that document…

> *Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10 (to the 4th*

power), and the non-carcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts.

The other document is the Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites (USEPA, 1998) that provides a cleanup level of 1 ppb TEQ for dioxins at residential sites for both Superfund and RCRA activities. This level corresponds to a 2.5 x 10^{-4} risk.

3. Do the reviewers know of any other contaminants associated with the World Trade Center that were not included in the COPC document or the Confirmation Cleaning Study that may serve as a surrogate for determining the risk from other contaminants? If so, please provide the details regarding these contaminants and the reasons why they should be considered. Provide citations for any references mentioned, and/or submit hard copies of the referenced documents.

I believe that EPA has adequately addressed the additional constituents encountered in sampling efforts at the WTC as reflected in Response to 2 above.

Attachment to Written Comments: Annette Guiseppi-Elie, Ph.D

Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions

********** DISCLAIMER **********

The following electronic file contains the text of a policy issued by the U.S. Environmental Protection Agency (EPA). This file has been reformatted to make it available to you in electronic form. Formatting (margins, page numbering, etc.) may be different than the original hard copy to make the document more easily readable on your computer screen. Where graphics have been removed, the editor has noted it in the text. This electronic file is a courtesy copy of the official policy. If any discrepancies are found, the file copy (hard copy original) which resides at the U.S. EPA provides the official policy.

****

APR 22 1991 OSWER DIRECTIVE 9355.0-30

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

MEMORANDUM

SUBJECT: Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions

FROM: Don R. Clay /s/
Assistant Administrator

TO: Directors, Waste Management Division
Regions I, IV, V, VII, VIII
Director, Emergency and Remedial Response Division
Region II
Directors, Hazardous Waste Management Division
Regions III, VI, IX
Director, Hazardous Waste Division,
Region X

Purpose

The purpose of this memorandum is to clarify the role of the baseline risk assessment in developing Superfund remedial alternatives and supporting risk management decisions. Specifically, the following points are made in the memorandum:

- Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10 (to the 4th power), and the non-carcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts. However, if MCLs or non-zero MCLGs are exceeded, action generally is warranted.

- Other chemical-specific ARARs may also be used to determine whether a site warrants remediation.
- A risk manager may also decide that a baseline risk level less than 10 (to the 4th power) is unacceptable due to site specific reasons and that remedial action is warranted.
- Compliance with a chemical-specific ARAR generally will be considered protective even if it is outside the risk range (unless) there are extenuating circumstances such as exposure to multiple contaminants or pathways of exposure).
- The upper boundary of the risk range is not a discrete line at 1 x 10 (to the 4th power), although EPA generally uses 1 x 10 (to the 4th power) in making risk management decisions. A specific risk estimate around 10 (to the 4th power) may be considered acceptable if justified based on site-specific conditions.
- The ROD should clearly justify the use of any non-standard exposure factors and the need for remedial action if baseline risks are within the generally acceptable risk range. The ROD should also include a table listing the final remediation goals and the corresponding risk level for each chemical of concern.

Background

The 1990 National Contingency Plan (NCP) (55 Fed. Reg. 8665-8865 (Mar. 8, 1990)) calls for a site-specific baseline risk assessment to be conducted, as appropriate, as part of the remedial investigation (Section 300.430(d)(1)). Specifically, the NCP states that the baseline risk assessment should "characterize the current and potential threats to human health and the environment that may be posed by contaminants migrating to ground water or surface water, releasing to air, leaching through soil, remaining in the soil, and bioaccumulating in the food chain" (Section 300.430(d)(4)). The primary purpose of the baseline risk assessment is to provide risk managers with an understanding of the actual and potential risks to human health and the environment posed by the site and any uncertainties associated with the assessment. This
information may be useful in determining whether a current or; potential threat to human health or the environment exists that warrants remedial action.

The "Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual - Part A" (HHEM) (EPA/540/1-89/002) provides guidance on how to conduct the human health portion of the baseline risk assessment. Volume II of the "Risk Assessment Guidance for Superfund" the "Environmental Evaluation Manual" (EPA/540/1-89/001) and the companion manual, "Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference" (EPA/600/3-89/013) provide guidance on conducting the environmental portion of the baseline risk assessment. Other pertinent guidance includes the "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (RI/FS guidance, EPA/540/G-89/004), which describes how the baseline risk assessment fits into the overall RI/FS process. "Guidance on Preparing Superfund Decision Documents" (ROD guidance) (EPA/624/1-87/001) provides information on how to document the results of the baseline risk assessment in the ROD.

Objective

The objective of this memorandum is to provide further guidance on how to use the baseline risk assessment to make risk management decisions such as determining whether remedial action under CERCLA Sections 104 or 106 is necessary. This memorandum also clarifies the use of the baseline risk assessment in selecting appropriate remedies under CERCLA Section 121, promotes consistency in preparing site-specific risk assessments, and helps ensure that

appropriate documentation from the baseline risk assessment is included in Superfund remedy selection documents.

Implementation

RISKS WARRANTING REMEDIAL ACTION

Whenever there is a release or substantial threat of release of a hazardous substance into the environment (or a release or threat of release into the environment of a pollutant or contaminant "which may present an imminent and substantial danger to public health or welfare"), Section 104(a)(1) of CERCLA provides EPA with the authority to take any response action consistent with the National Contingency Plan it deems necessary to protect public health or welfare or the environment. Section 106 of CERCLA grants EPA the authority to require potentially responsible parties (or others) to perform removal or remedial actions " when the President determines that there may be an imminent and substantial endangerment to the public health or welfare or the environment because of an actual or threatened release of a hazardous substance form a facility."

As a general policy and in order to operate a unified Superfund program, EPA generally uses the results of the baseline risk assessment to establish the basis for taking a remedial action using either Section 104 or 106 authority. EPA may use the results of the baseline risk assessments to determine whether a release or threatened release poses an unacceptable risk to human health or the environment that warrants remedial action and to determine if a site presents an imminent and substantial endangerment. The risk assessment methodology for all sites should be the same regardless of whether the RI/FS or remedial design and remedial action is performed by EPA or potentially responsible parties.

Generally, where the baseline risk assessment indicates that a cumulative site risk to an individual using reasonable maximum exposure assumptions for either current or future land use exceeds the 10 (to the 4th power) lifetime excess cancer risk end of the risk range, action under CERCLA is generally warranted at the site. For sites where the cumulative site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10 (to the 4th power), action generally is not warranted, but may be warranted if a chemical specific standard that defines acceptable risk is violated or unless there are noncarcinogenic effects or an adverse environmental impact that warrants action. A risk manager may also decide that a lower level of risk to human health is unacceptable and that remedial action is warranted where, for example, there are uncertainties in the risk assessment results. Records of Decision for remedial actions taken at sites posing risks within the 10 (to the 4th power) to 10-6 risk
range must explain why remedial why remedial action is warranted. The cumulative site baseline risk should include all media that the reasonable maximum exposure scenario indicates are appropriate to combine and should not assume that institutional controls or fences will account for risk reduction. For noncarcinogenic effects of toxicants, unacceptable risk occurs when exposures exceed levels which represent concentrations to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, as appropriate to address teratogenic and developmental effects. Chemical specific standards that define acceptable risk levels (e.g., non-zero MCLGs, MCLs) also may be used to determine whether an exposure is associated with an unacceptable risk to human health or the

environment and whether remedial action under Section 104 or 106 is warranted. For ground water actions, MCLs and non-zero MCLGs will generally be used to gauge whether remedial action is warranted.

EPA used the general 10 (to the 4th power) to 10-6 risk range as a "target range" within which the Agency strives to manage risks as part of a Superfund cleanup. Once a decision has been made to make an action, the Agency has expressed a preference for cleanups achieving the more protective end of the range (i.e., 10-6), although waste management strategies achieving reductions in site risks anywhere within the risk range may be deemed acceptable by the EPA risk manager. Furthermore, the upper boundary of the risk range is not a discrete line at 1 x 10 (to the 4th power), although EPA generally uses 1 x 10 (to the 4^{th} power) in making risk management decisions. A specific risk estimate around 10 (to the 4th power) may be considered acceptable if justified based on site-specific conditions, including any remaining uncertainties on the nature and extent of contamination and associated risks. Therefore, in certain cases EPA may consider risk estimates slightly greater than 1 x 10 (to the 4th power) to be protective.

When an ARAR for a specific chemical (or in some cases a group of chemicals) defines an acceptable level of exposure, compliance with the ARAR will generally be considered protective even if it is outside the risk range (unless there are extenuating circumstances such as exposure
to multiple contaminants or pathways of exposure). Conversely, in certain situations EPA may determine that risks less than 1 x 10 (to the 4th power) are not sufficiently protective and warrant remedial action. Where current conditions have not resulted in a release posing risks that warrant action but there is a significant possibility that a release will occur that is likely to result in an unacceptable risk, remedial action may also be taken. The significance of the potential future release may be evaluated in part based on the quantities of material at the site and the environmental setting.

RISKS CONSIDERED IN RISK MANAGEMENT DECISION

As noted above, both current and reasonably likely future risks need to be considered in order to demonstrate that a site does not present an unacceptable risk to human health and the environment. An adequate consideration of future risk may necessitate the assessment of risks assuming a land use different from that which currently exists at the site . The potential land use associated with the highest level of exposure and risk that can reasonably be expected to occur should be addressed in the baseline risk assessment. Further, this land use and these exposure assumptions should be used in developing remediation goals.

The preamble to the NCP states that EPA will consider future land use as residential in many cases. In general, residential area should be assumed to remain residential; and undeveloped area can be assumed to be residential in the future unless sites are in area where residential land use is unreasonable. Often the exposure scenarios based on potential future residential land use provide the greatest risk estimates (e.g., reasonable maximum exposure scenario) and are important
considerations in deciding whether to take action (55 Fed. Reg. At 8710).

However, the NCP also states that " the assumption of future residential land use may not be justifiable if the probability that the site will support residential use in the future is small." Sites that are surrounded by operating industrial facilities can be assumed to remain as industrial area unless there is an indication that this is not appropriate. Other land uses, such as recreational or agricultural, may be used, if appropriate. When exposures based on reasonable future land

use are used to estimate risk, the NCP preamble states that the ROD " should include a qualitative assessment of the likelihood that the assumed future land use will occur" (55 Fed. Reg. at 8710).

Unacceptable environmental risks also may prompt remedial action and may occur where there is no significant risk to human health. Threats or potential threats to sensitive habitats, such as wetlands, and critical habitats of species protected under the Endangered Species Acts are especially important to consider when determining whether to take an action under CERCLA Section 104 or 106. Ambient Water Quality Criteria for aquatic organisms are chemical-specific standards that will generally be considered when determining whether to take an action based on the environmental risk of releases to surface waters.

NO-ACTION DECISIONS

If the baseline risk assessment and the comparison of exposure concentrations to chemical-specific standards indicates that there is no unacceptable risk to human health or the environment and that no remedial action is warranted, then the CERCLA Section 121 cleanup standards for selection of a Superfund remedy, including the requirement to meet applicable or relevant and appropriate requirements (ARARs), are not triggered. CERCLA section 121 (a) requires only that those remedial actions that are "determined to be necessary ... Under section 104 or ... 106 ... be selected in accordance with section 121." If EPA determines that an action is necessary, the remedial action must attain ARARs, unless a waiver is invoked. Of course, sites that do not warrant action under CERCLA sections 104 or 106 may warrant action under another State or Federal statute, such as RCRA subtitle D requirements for the appropriate closure of a solid waste landfill.

The decision not to take action at an NPL site under section 104 and 106 should also be documented in a ROD. The decision documentation process should include the preparation of a proposed plan for public comment, ROD and eventually a closeout report and Federal Register deletion notice.

POINT OF DEPARTURE WHEN ACTION WARRANTED

Once remedial action has been determined to be warranted, the results of the baseline risk assessment may be used to modify preliminary remediation goals. These preliminary goals are developed at scoping based on ARARs and the 10-6 cancer risk point of departure pursuant to NCP section 300.430(e)(2)(i).

USE OF BASELINE RISK ASSESSMENT TO MODIFY PRELIMINARY REMEDIATION GOALS

Remediation goals developed under CERCLA section 121 are generally medium-specific chemical concentrations that will pose no unacceptable threat to human health and the environment. preliminary remediation goals are developed early in the RI/FS process based on ARARs and other readily available information, such as concentrations associated with 10 (to the 6th power) cancer risk or a hazard quotient equal to one for noncarcinogens calculated from EPA toxicity information. These preliminary goals may be modified based on results of the baseline risk assessment, which clarifies exposure pathways and may identify situations where cumulative risk of multiple contaminants or multiple exposure pathways at the site indicate the need for more or less stringent cleanup levels than those initially developed as preliminary remediation goals. In addition to being modified based on the baseline risk assessment, preliminary remediation goals and the corresponding cleanup levels may also be modified based

on the given waste management strategy selected at the time of remedy selection that is based on the balancing of the nine criteria used for remedy selection (55 Fed.Reg. at 8717 and 8718).

EARLY AND INTERIM ACTIONS

Early operable unit actions (e.g., hot spot removal and treatment) and interim actions (e.g., temporary storage or ground water plume containment) may be taken to respond to an immediate site threat or to take advantage of an opportunity to significantly reduce risk quickly (55 Fed. Reg. at 8705). For example, an interim containment action may be particularly useful early in the process for complicated ground water remedial actions, where concentrations greater than MCLS provide a good indication that remediation of a potential drinking water source is necessary; such quick remedial action is important to prevent further spread of the contaminant plume while a final ground water remedy is being developed.

Early and interim action RODs do not require a completed baseline risk assessment, although enough information must be available to demonstrate the potential for risk and the need to take action. Data sufficient to support the interim action decision can be extracted from the ongoing RI/FS for the site and set out in a focused feasibility study or other appropriate document that includes a short analysis of a limited number of alternatives (55 Fed. Reg. at 8704). These data should include a summary of contaminants of concern, concentrations and relevant exposure information. A discussion should accompany these data explaining the need for immediate remedial action based on the presence of contamination that, if left unaddressed in the short-term, either contributes immediate risk or is likely to contribute to increased site risk or degradation of the environment/ natural resources. The early and interim action RODs should note that some exposure pathways at the site may not be addressed by the action.

An interim action ROD eventually must be followed by a subsequent ROD for that operable unit based on the complete RI/FS, that includes the baseline risk assessment, in order to document long-term protection of human health and the environment at that portion of the site. The interim action ROD, however, should demonstrate qualitatively (and quantitatively if possible that these is a risk or potential for risk and explain how the temporary measures selected will address a portion of this risk.

DOCUMENTATION OF BASELINE RISK ASSESSMENT RESULTS IN THE ROD

The Summary of Site Risks section of the ROD should include a discussion of the risks associated with current and future land use and a table presenting these risk levels for each exposure medium (e.g., direct contact with soil by potential future residents exposed via incidental soil ingestion and dermal contact). In some situations, risks from exposure via more than one medium (e.g, soil and drinking water) will affect the same potentially exposed individual at the same time. It is appropriate in these situations to combine the risk that an individual may be exposed to from a site.

In addition to summarizing the baseline risk assessment information, the ROD (except no-action RODs) should include how remedial alternatives will reduce risks by achieving cleanup levels through treatment or by eliminating exposures through engineering controls for each contaminant of concern in each appropriate medium.

The Comparative Analysis should include a discussion of each of the nine criteria; consideration of risk is part of the discussion of several of the criteria. The discussion of overall protection of human health and the environment should include a discussion of how the remedy

will eliminate, reduce, or control risks identified in the baseline risk assessment posed through each pathway and whether exposure levels will be reduced to acceptable levels. For example, if direct human contact with contaminated soil is identified as a significant risk at a site, the ROD (except no-action RODs) should indicate how the selected remedy will eliminate or control exposures to ensure protection of human health. The discussion of long-term effectiveness and permanence should include, where appropriate, an assessment of the residual risk from untreated residual waste remaining at the site. The short-term effectiveness discussion should address risks during remedial action to those on-site and nearby.

Finally, that part of the Decision Summary in the ROD that focuses on the selected remedy should show:

- the chemical-specific remediation level and corresponding chemical-specific risk level(s) to be attained at the conclusion of the response action and the points (or area) of compliance for the media being addressed; and
- The lead agency's basis for the remediation levels (e.g., risk calculation, ARARs).

The attached table, "Remediation levels and Corresponding Risks," provides a direct means of displaying this information for health risks and, where appropriate, environment protection (Table 1). The table should be completed for all media for which the ROD selects final cleanup levels. The table should serve as a summary of text in the selected remedy section of the ROD Decision Summary. For interim action RODs, only qualitative statements may be possible.

Additional guidance on the baseline risk assessment and its role in remedy selection is available from several sources. For guidance on the baseline risk assessment contact:

David Bennett, Chief
Toxics Integration Branch (OS-230)
Hazardous Site Evaluation Division
Office of Emergency and Remedial Response
phone: (FTS) or (202) 475-9486.

For additional guidance on the interaction of the baseline risk assessment and Superfund remedy selection, contact:

David Copper
Remedial Operations and Guidance Branch (OS-220W)
Hazardous Site Control Division
Office of Emergency and Remedial Response
phone: (FTS) 398-8361
(commercial phone: (703) 308-8361)

For guidance on enforcement-lead sites contact:

Stephen Ells
Guidance and Evaluation Branch (OS-510)
CERCLA Enforcement Division
Office of Waste Programs Enforcement
phone: (FTS) or (202) 475-9803.

NOTICE: The policies set out in this memorandum are intended solely as guidance. They are not intended, nor can they be relied upon, to create any rights enforceable by any party in litigation with the United States. EPA officials may decide to follow the guidance provided in

this memorandum, or to act at variance with the guidance, based on an analysis of specific site circumstances. Remedy selection decisions are made and justified on a case-specific basis. The Agency also reserves the right to change this guidance at any time without public notice.

---------- ATTACHMENT ----------

======== Editor's Note ==========

[NOTE: At this point in the document, a table was included, entitled "Remediation Goals and Corresponding Risks." This graphic was not included in this electronic compendium because it could not be reproduced in a compatible format. -Ed.]

==========

Return to the top of this document.
Return to OSRE Home Page

Last Updated: February 27, 1998
URL: http://es.epa.gov/oeca/osre/910422.html

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

APR 13 1998

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

OSWER Directive 9200.4-26

MEMORANDUM

SUBJECT: Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites

FROM: Timothy Fields, Jr. Acting Administrator /s/
Office of Solid Waste and Emergency Response

TO: Director, Office of Site Remediation and Restoration
Region I
Director, Emergency and Remedial Response Division
Region II
Director, Division of Environmental Planning and Protection
Region II
Director, Hazardous Waste Management Division
Regions IX
Director, Waste Management Division
Region IV
Director, Waste, Pesticides, & Toxics Division
Region V
Director, RCRA Multimedia Planning & Permitting Division
Region V
Director, Superfund Division
Regions III, V, VI, VII
Assistant Regional Administrator, office of Ecosystems Protection and Remediation
Region VIII
Director, Hazardous Waste Program
Region VIII
Director, Office of Environmental Cleanup
Region X
Director, Office of Waste and Chemical Management
Region X

PURPOSE

The purpose of this Directive is to recommend preliminary remediation goals (PRGs) or starting points for setting cleanup levels for dioxin in soil at Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA) corrective action sites. These recommended levels are to be used pending the release of the U.S. Environmental Protection Agency (EPA) comprehensive dioxin reassessment report and cross-program assessment of the impacts of the report. One ppb (TEQs, or toxicity equivalents) is to be generally used as a starting point for setting cleanup levels for CERCLA removal sites and as a PRG for remedial sites for dioxin in surface soil involving a residential exposure scenario. For commercial/industrial exposure scenarios, a soil level within the range of 5 ppb to 20 ppb (TEQs) should generally be used as a starting point for setting cleanup levels at CERCLA removal sites and as a PRG for remedial sites for dioxin in surface soil. These levels are recommended unless extenuating site-specific circumstances warrant a different level.

The dioxin levels discussed in this Directive are also generally recommended for actions taken under RCRA at corrective action sites. The recommended levels of 1 ppb (TEQs) for residential soils and within the range of 5 ppb to 20 ppb (TEQs) for commercial/industrial soils should generally be used as starting points in setting soil cleanup levels at RCRA corrective action sites. These levels are generally consistent with soil cleanup levels set at RCRA facilities throughout the country where dioxin is a principal contaminant of concern at the facility. However, because states are the primary implementors of the RCRA Corrective Action program, this Directive does not prescribe specific procedures for implementation under RCRA.

This Directive sets forth the policy basis for these recommended levels and prescribes procedures for implementing these recommendations.

BACKGROUND

To date, EPA has generally selected 1 ppb as a cleanup level for dioxin in residential soils at Superfund and RCRA cleanup sites where dioxin is a principal contaminant of concern at the facility. EPA has also, to date, generally selected a cleanup level for dioxin within the range of 5 ppb to 20 ppb for commercial/industrial soils at Superfund and RCRA cleanup sites where dioxin is a principal contaminant of concern at the facility. The levels that EPA has selected at these sites are protective of human health and the environment. Based on presently available information, and using standard default assumptions for reasonable maximum exposure scenarios, the upper-

bound lifetime excess cancer risk from residential exposure to a concentration of 1 ppb dioxin is approximately 2.5 x 10^{-4}, which is at the higher end of the range of excess cancer risks that are generally acceptable at Superfund sites. The calculated upper-bound excess cancer risk associated with a lifetime commercial/industrial exposure to 5 ppb, or the lower end of the range recommended for commercial/industrial soils, is approximately 1.3 x 10^{-4}, which is also within the CERCLA risk range. It should be noted that there is more difficulty in generalizing about the cancer risk associated with commercial/industrial cleanup levels than there is with residential cleanup levels due to the greater variability in exposures associated with commercial/industrial scenarios. Accordingly, the consultation process for Superfund sites referenced in the implementation section of this Directive should be used to ensure the selection of appropriate, protective dioxin levels at CERCLA commercial/industrial sites. Similarly, for RCRA corrective action sites, please refer to the implementation section of this Directive.

EPA is presently completing work on a comprehensive reassessment of the toxicity of dioxin, to be embodied in the documents entitled "Health Assessment Document for 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds" and "Estimating Exposure to Dioxin-like Compounds." The reassessment report, which is scheduled to be issued in 1998, will represent the culmination of an Agency-wide effort to collect, analyze and synthesize all of the available information about dioxin. It has undergone significant internal and external review and is one of the most comprehensive evaluations of toxicity of a chemical ever performed by the Agency. Following release of the report, the Office of Solid Waste and Emergency Response (OSWER) will participate in a cross-program review of the implications of the report for the regulation and management of dioxin by EPA. We anticipate that this review will culminate in OSWER guidance addressing the management of dioxin at CERCLA and RCRA sites.

The Office of Solid Waste and Emergency Response does not believe it is prudent to establish new, and possibly varying, precedents for Superfund or RCRA dioxin levels just prior to the release of this reassessment report. As with any other pollutant, it is important that EPA ensure appropriate national consistency in remediation efforts. The Agency has used 1 ppb as a residential cleanup level and between 5 ppb and 20 ppb as a commercial/industrial cleanup level at CERCLA and RCRA cleanup sites for dioxin in soil in the past; it is anticipated that OSWER will be issuing guidance, informed by the reassessment effort, that will provide a basis for the selection of dioxin cleanup levels in the near future. In the interim, for sites that require the establishment of a final dioxin soil cleanup level prior to the release of the reassessment report and

development of OSWER guidance, EPA should generally use 1 ppb (TEQs) as a starting point for residential soil cleanup levels for CERCLA non-time critical removal sites (time permitting, for emergency and time critical sites) and as a PRG for remedial sites. EPA should generally use a level within the range of 5 ppb to 20 ppb (TEQs) as a starting point for cleanup levels at CERCLA non-time critical removal sites (time permitting, for emergency and time critical sites) and as a PRG for remedial sites for commercial/industrial soil. These levels should also be used as starting points in setting soil cleanup levels at RCRA corrective action sites.

For CERCLA remedial sites, consistent with 40 CFR § 300.430(f)(5)(iii)(D), EPA should commit to reviewing Records of Decision (RODs) (i.e., RODs in which this Directive has been used to develop dioxin soil cleanup levels) promptly following the release and analysis of the reassessment report and OSWER guidance, and, if necessary, to making changes to the RODs and cleanup actions, based on the information contained in the reassessment report and in the OSWER guidance. Similarly, in the case of non-time critical removal actions (time permitting, for emergency and time critical actions), EPA should commit to reviewing Action Memoranda promptly following the release and analysis of the reassessment report and OSWER guidance, and, if necessary, to making changes to the Action Memoranda and cleanup actions, based on the information contained in the reassessment report and the OSWER guidance. EPA should similarly commit to reviewing RCRA cleanup decisions (i.e., decisions for which this Directive has been used) promptly following the release and analysis of the reassessment report and OSWER guidance.

IMPLEMENTATION

Regional management should consult with the appropriate Office of Emergency and Remedial Response (OERR) Regional Centers on all proposed Fund and Potentially Responsible Party-lead site decisions under CERCLA, including other Federal agency-lead and state-lead site decisions, involving the development of dioxin soil cleanup levels for non-time critical removal sites (time permitting, for emergency and time critical removal sites) and remedial sites. Consultation should be initiated at the risk assessment stage. For Federal agency-lead sites, OERR will, in turn, notify the Federal Facilities Restoration Reuse Office of ongoing consultations. The Office of Site Remediation Enforcement will provide support if enforcement issues are identified. For consultation procedures, refer to the OSWER "Headquarters Consultation for Dioxin Sites", 9200.4-19, December 13, 1996, plus the OSWER "Consolidated Guide to Consultation Procedures for Superfund Response Decisions", 9200.1-18FS, May 1997.

In the case of EPA-lead RCRA corrective action sites, Regions should provide the Office of Solid Waste Permits and State Programs Division (OSW/PSPD) with proposed dioxin soil cleanup levels (i.e., prior to notice and comment) in order to ensure appropriate implementation of this Directive. For state-lead RCRA corrective action sites, it is also recommended that states use the dioxin levels recommended by this Directive as starting points in setting soil cleanup levels. States are encouraged to share their approaches with the Regions in a manner consistent with established procedures for EPA support and oversight of state RCRA Corrective Action programs.

The levels in this Directive are recommended unless extenuating site-specific circumstances warrant different levels, a more stringent state applicable or relevant and appropriate requirement (ARAR) establishes a cleanup level at CERCLA sites, or a more stringent state requirement applies at RCRA sites. We recommend that levels other than 1 ppb (TEQs) for residential soils and outside the range of 5 ppb to 20 ppb (TEQs) for commercial/industrial soils be used only where evidence exists that risks posed by the site differ from risks estimated using standard national default guidance values. These recommendations apply to RCRA corrective actions, CERCLA non-time critical removal actions (time permitting, for emergency and time-critical actions) and CERCLA remedial actions where cleanup levels are to be developed for dioxin in soil, regardless of whether dioxin itself drives the decision-making process.

The recommended levels found in this Directive, generally considered protective of human health and the environment, apply to surface soils. Please note that with respect to human health, these levels are based on the direct contact exposure pathway. The recommended levels in this Directive do not apply to other exposure pathways, such as migration of soil contaminants to ground water or to agricultural products. While the focus of this Directive is on soils, these recommended levels also apply to sediments in the event that this environmental medium is considered to be a direct exposure pathway for human receptors.

This document provides guidance to EPA staff. The guidance is designed to communicate national policy on dioxin cleanups for soil. The document does not, however, substitute for EPA's statutes or regulations, nor is it a regulation itself. Thus, it cannot impose legally-binding requirements on EPA, states, or the regulated community, and may not apply to a particular situation based upon the circumstances. EPA may change this guidance in the future, as appropriate.

If you have any questions concerning this Directive, please contact either Marlene Berg at (703)603-8701 in Headquarters or Elmer Akin of Region 4 at (404)562-8634, as Marlene and Elmer are

co-chairs of the Superfund Dioxin Workgroup. For the RCRA Corrective Action program, please contact Robert Hall of the Office of Solid Waste Permits and State Programs Division at (703)308-8484. Attached, for your information, is a list of Regional points of contact who are serving on the dioxin workgroup.

Attachment: Superfund Dioxin Workgroup: Regional Points of Contact

cc: Mike Shapiro, OSWER
Peter Grevatt, OSWER
Steve Luftig, OERR
Elaine Davies, OERR
Larry Reed, OERR
Gershon Bergeisen, OERR
David Bennett, OERR
Bruce Means, OERR
Betsy Shaw, OERR
Paul Nadeau, OERR
Tom Sheckells OERR
Murray Newton, OERR
John Cunningham, OERR
Dave Evans, OERR
Joe LaFornara, OERR
Mark Mjoness, OERR
Jim Woolford, FFRRO
Elizabeth Cotsworth, OSW
Barry Breen, OSRE
Tudor Davies, OW
Craig Hooks, FFEO
Earl Salo, OGC
Bill Sanders, OPPT
Bill Farland, ORD
Regional Counsel, Regions I-X
Peggy Schwebke, Region 5
Superfund Dioxin Workgroup

John Kominsky

ENVIRONMENTAL QUALITY MANAGEMENT, INC.
1800 Carillon Boulevard
Cincinnati, Ohio 45240
(513) 825-7500
fax (513) 825-7495
www.eqm.com

March 29, 2004

Ms. Kate Schalk
Conference Management Group
ERG
110 Hartwell Avenue
Lexington, MA 02421-3126

Re: Asbestos as a Surrogate for Determining Risk from Other WTC Related Contaminants

Dear Ms. Schalk:

The EPA, Region 2, *WTC Residential Confirmation Cleaning Study* (May 2003) concluded that "*conducting asbestos air sampling was a conservative method for determining if additional cleaning was needed.*" Accordingly, this letter offers my opinions regarding the following three questions presented to World Trade Center Peer Review Consultants:

- In the manner used by EPA, is the selection of asbestos as a surrogate for determining risk from other WTC-related contaminants supported?
- Do other contaminants that were measured in the *Residential Confirmation Cleaning Study* provide equally good or better surrogates for determining risk from other contaminants?
- Do the reviewers know of any other contaminants associated with the World Trade Center that were not included in the COPC document or the Confirmation Cleaning Study that may serve as a surrogate for determining the risk from other contaminants?

Question #1: Is selection of asbestos as surrogate for determining risk from other WTC-related contaminants supported?

WTC-related dust consists of a unique mixture of synthetic vitreous fibers, mineral components of concrete and cement, mineral components of building wallboard, glass shards, asbestos, heavy metals, and high temperature combustion products.[1,2,3] Analysis of confidential data for a single building showed that levels of contaminants (such as

---

1 Chatfield, EJ and Kominsky, JR. Summary Report: *Characterization of Particulate Found in Apartments After Destruction of the World Trade Center* (October 12, 2001).
2 EPA, Region 2, Database of Environmental Sampling Results (Bulk and Settled Dust Samples).
3 Lioy, JL et al. *Dust: A Metric for Use in Residential and Building Exposure Assessment and Source Characterization*. Environ. Health Persp. 110: 969-983, 2002.

asbestos, lead, and other contaminants) in WTC dust are generally proportional to each other and to the measured surface dust concentration. In addition to the linear correspondence, it was noticed that for a given dust concentration the variability of a contaminant concentration was between one and two orders of magnitude. Most likely, this is because the levels of different contaminants are not intrinsically dependent on each other, and because the dust samples from which the measurements were taken were different. Although it is likely that the same conclusion would be realized for the apartments involved in the *Residential Confirmation Cleaning Study*, it is recommended that a similar analysis be performed on the pre-cleaning surface data from the cleaning study and the EPA Region 2 Database of Environmental Sampling Results, as necessary. This analysis could include preparation of log-log scatter plots of the contamination data versus measured dust concentration. *The aforementioned data analyses strongly support the selection of asbestos as a surrogate for determining risk from other WTC-related contaminants*.

The use of asbestos as a surrogate or marker for recontamination of the previously cleaned apartments allows for a quantitative determination of risk to the occupants, but also enables effective comparability of the *Residential Confirmation Cleaning Study* database with the planned resampling data sets. The resuspension and buoyancy characteristics of asbestos fibers further support its selection as a surrogate.[4]

The use of asbestos as a risk surrogate is predicated on the premise that surficial contamination will be resuspended via intentional air disturbance; i.e., aggressive or modified-aggressive air sampling, as applicable. Therefore, it is of paramount importance that the resampling protocol includes specific direction to ensure that any residual material in "hidden or not readily accessible areas" be sufficiently disturbed and re-entrained in the air stream of the apartment. These areas can be identified using the concept of "*Best Engineering Judgement*."[5]

Analysis of settled and bulk dusts in apartments contaminated with WTC dust showed that the asbestos was consistently serpentine (chrysotile); no amphiboles were identified.[1] Accordingly, I agree with Greg Meeker's comments:[6] *"For chrysotile, the finest fibers are below the resolution limit of optical techniques, but it is these finest fibers that are most likely to be re-suspended and be present after initial cleaning. ...TEM is the only appropriate technique for analysis of asbestos in this situation"* to ensure confidence in the analysis.

---

4 Heath Effects Institute-Asbestos Research (HEI-AR). *Asbestos in Public and Commercial Buildings*, Chapter 4.5.3 " *Secondary Releases to the Building Environment*" (1991).

5 Seiler, FA, Davis, HT, Kominsky, JR, et al. *Use of Risk Assessment Methods in the Certification of Decontaminated Buildings*. Risk Analysis, Vol. 7, No.4: 487-495 (1987).

6 G. Meeker (USGS Denver Microbeam Laboratory). Comments on Draft to Peer Review from G. Meeker.

Question #2: Do other contaminants that were measured in the Residential Confirmation Cleaning Study provide equally good or better surrogates for determining risk from other contaminants?

As noted above for asbestos, analysis of confidential data showed that levels of contaminants including lead in WTC dust are generally proportional to each other and to the measured surface dust concentration. Accordingly, lead would be a reasonable supplemental surrogate to using asbestos. However, the use of lead or any other metal with only a limited subset of sample analyses from the *Residential Confirmation Cleaning Study* cannot address the question of recontamination, but could present data on "existing contamination" or "presence of WTC dust."

Question #3: Any other contaminants associated with the World Trade Center that were not included in the COPC document or the Confirmation Cleaning Study that may serve as a surrogate for determining the risk from other contaminants?

No.

Thank you for the opportunity to participate in the WTC Peer Review Consultants Panel. Should you have any questions regarding these opinions or require supplemental information, please contact me at (513) 742.7216 or ***jkominsky@eqm.com*** (e-mail).

Respectfully submitted,

ENVIRONMENTAL QUALITY MANAGEMENT, INC.

John R. Kominsky

John R. Kominsky, M.Sc., CIH, CSP, CHMM
Vice President

Robert P. Nolan, Ph.D.

To: Kate Schalk

From: RP Nolan

Date: March 28, 2004

Re: Charge for the WTC Peer Consultants

Charge Question 1: The Confirmation Cleaning Study concluded that "asbestos air sampling was a conservative method for determining if additional cleaning was required." Given this conclusion and its supporting data in the Confirmation Cleaning Study and all other data sources, is the selection of asbestos as a surrogate for determining the risk from other contaminants supported? Please provide a detailed response, explaining the reason for your yes or no answer.

Answer 1: Yes, if the cleaning is effective enough to reduce the asbestos concentrations below the health-based benchmarks it is reasonable to assume the other five contaminants of potential concern (COPC) are below their benchmarks as well. The COPC were selected after screening for over 300 substances using more than a quarter of a million analyzes of air and settled dust samples. The substances analyzed for were wide ranging, many classes of organic compounds (pesticides, volatile organic compound (VOCs), semi-volatile organic compounds (SVOCs), dioxins, PCBs, PAHs) and inorganic compounds (asbestos, crystalline silica (more specifically quartz), various metals, synthetic vitreous fibers) were included in the screening. Samples were collected from the general and residential environments to determine if the events of 9/11 elevated the concentrations of any of these many substances.

From this screening study six contaminants of potential concern (asbestos, quartz, synthetic vitreous fibers (SVF), dioxin, lead and polycyclic aromatic hydrocarbons (PAHs)) were identified. The COPC can be divided into two groups, substances commonly used in construction (asbestos, quartz, synthetic vitreous fibers and lead) and substances associated with combustion products from the jet fuel and the resulting fires (dioxins and PAHs). The two COPC present at the highest concentrations in the settled dust were synthetic vitreous fibers (a group of man-made mineral fibers that includes fiber glass) and quartz. At lower concentrations, asbestos and lead, are present in a high percentage of the settled dust samples analyzed. One report on air and settled dust samples collected shortly after 9/11 reported the presence of several asbestos fiber types (chrysotile, amosite and a sodium rich tremolite called richterite). Later analysis on more samples reported chrysotile asbestos to be the only asbestos fiber type present. All of the COPC are commonly found in the urban environment and therefore analytical results will not provide a "fingerprint" for WTC related dust indoors. However, the analytical data as a whole indicated the concentrations of the six COPC in Lower Manhattan were considered higher than one would expect when comparing them to background levels in areas of Manhattan not affected by 9/11.

These results are consistent with what is known about the composition of the WTC fireproofing and the construction materials in common use during the period in which it was built.

The combustion products – dioxin and polycyclic aromatic hydrocarbons (PAHs) - are not single compounds but rather classes of chemical compounds made up of structurally related individual chemical compounds which have a range of toxicological and carcinogenic properties. The analyzes of these compounds undertaken by the EPA and their co-workers attempted to treat these two groups in a manner which addresses the range in carcinogenic potency associated with the various individual chemical compounds. The very low concentration of these complex mixtures of organic chemicals makes monitoring for them problematic. For example, dioxin was present at a concentration of about 0.001ng per cubic meter in the air and requires days to collect one air sample. The analysis of such low concentrations is time consuming - leading to long turn around times, ending with results that are unlikely to generate much information useful for public health policy. In addition exposure to dioxin by dietary intake is usually more significant than inhalation. Although PAHs are present at higher concentration many of the same arguments can be applied to this complex mixture of individual chemical compounds.

Review of the documents provided indicates that the six contaminants of potential concern are aptly named in that they are of potential concern. None of the six contaminants are present in air or settled dust at concentrations which present a clear and present danger and each is known to occur in the urban environment. The information available indicates that the events of 9/11 increased the level of these six contaminants in Lower Manhattan above the historical background that would normally be expected. This statement applies mainly to settled dust as the airborne concentrations of contaminants returned to levels similar, if not within, background weeks to a few months post-9/11. Little is known about the very heavy exposures to airborne particulates on and for about a week after 9/11. It is important to keep in mind that while the six COPC are all present at low concentrations in the settled dust there is a lot of settled dust and the assistance offered to aide in establishing an effective cleaning protocol, residential cleaning and air monitoring seems justified based on the data provided.

The setting of the health-based benchmarks and the development of the cleaning protocols appear to have occurred almost simultaneously. The following are the health-based benchmarks developed for post cleaning evaluation:

COPC	**Indoor Air**	**Settled Dust**
Asbestos	0.0009f/mL	n/a
Quartz	5μg/m^3	n/a
SVF	0.01f/mL	n/a
Lead	0.7μg/m^3	25μg/ft^2
Dioxin	0.001ng/m^3	2ng/m^2
PAHs	0.2μg/m^3	150μg/m^2

These six health-based benchmarks were developed in a logical manner under an extremely demanding time schedule. Although reasonable people might argue about the details, exactly

what the indoor air levels should be, setting as a goal a lifetime risk of 1 excess death in 10,000 and using exposure by inhalation seems a reasonable approach based on the information presented in the reports. The IRIS asbestos risk assessment is not specific for chrysotile asbestos, the asbestos fiber type found in the air and settle dust in Lower Manhattan post- 9/11, but rather a sort of average of the different types from the available asbestos epidemiology. However, using an over estimate for the risk of asbestos-related disease helps to justify using it as a surrogate for the other five COPC. Other arguments could be made about the quartz and SVF exposures that the risks are likely to be quite a bit lower than those estimates given in the benchmarks.

The cleaning protocol was validated by using it to clean a heavily contaminated, mixed use building, on Liberty Street. The cleaning protocol required the use of HEPA vacuums that efficiently collect and trap any particulate matter – asbestos, lead, SVF or quartz. The PAHs or dioxin would most likely be on the surface the particulate matter and be vacuumed up with the particulates. In addition the vertical and horizontal surfaces were clean by wet wiping. This protocol was then used to clean 3,400 apartments in 480 buildings each with post-cleaning air monitoring and another 800 apartments with only air monitoring. The cleaning and air monitoring effort addressed a significant percentage of the apartments in Lower Manhattan as the 2000 Census reports 16,482 housing units within three quarters of a mile of the WTC. As inhalation was the route of exposure for the health-based benchmarks after cleaning the apartments were air sampled in an effort to demonstrate that airborne asbestos levels were below 0.0009 fibers of asbestos (greater than 5μm in length) per milliliter of air. These air samples were not collected under passive conditions but rather leaf blowers or fans were used to generate air movement considerably above what normally occurs in apartments. If the settled dust was not adequately cleaned up it would be re-entrained into the air and the air sampling would be able to determine if the health-based benchmark was exceeded. The air sampling undertaken for the asbestos would also identify any SVFs which were airborne post-cleaning.

Charge Question 2: Do other contaminants that were measured in the Confirmation Cleaning Study provide equally good or better surrogates for determining the risk from other contaminants? If yes, please describe in detail which contaminants you would consider and why. If no, provide a justification for your response.

Answer 2: No, analysis of none of the other five COPC are equally good or better than using asbestos. Of the six COPC the best scientific case for non-occupational exposure leading to increased risk of cancer, particularly mesothelioma, can be made for asbestos and therefore monitoring for asbestos post-cleaning is required. As noted earlier there was a significant concentration of SVF in the WTC settled dust. The type of analysis undertaken for asbestos – fiber counting by microscopy- would indicate if increased airborne levels of SVF were occurring in the apartments post-cleaning and therefore monitoring for SVF is not necessary. The quartz and lead would be predominantly in particulate form and the HEPA vacuuming, effective enough to remove relatively high concentrations of SVF and relatively low concentration of asbestos should be effective at removing the two types of particulates. It is worth noting that this type of vacuum was used to clean sites contaminated with anthrax.

Charge Question 3: Do the reviewers know of any other contaminants associated with the World Trade Center that were not included in the COPC document or the Confirmation Cleaning

Study that may serve as a surrogate for determining the risk from other contaminants? If so, please provide the details regarding these contaminants and the reasons why they should be considered. Provide citations for any references mentioned and/or submit hard copies of the referenced documents.

Answer 3: No. EPA has opined in the reports provided that occupational standards should generally not be used as a basis for environmental health criteria and that exposure data for the very intense exposures post-9/11 are not available. The argument is given that those occupationally employed are healthier than the general population which includes individuals of different ages and health status than the working population and these considerations are not reflected in occupational standards. It seems that two important sources of information have not been evaluated which would be useful. Were hospital records reviewed for admissions of sensitive populations for example asthmatics post-9/11? Did the NYC mortality post-9/11 show any trend like those reported for the acute air pollution episodes in London with smog from December 5 to the 9 in 1952?

Clifford P. Weisel, Ph.D.

Professor
Environmental & Occupational Health Sciences Institute
Robert Wood Johnson Medical School – UMDNJ
Piscataway, NJ 08854

Scientific Input on Issues Related to EPA's Response Activities to the Attacks on the World Trade Center (Task Order #59, EPA Contract 68-C-02-060)

1. *The Confirmation Cleaning Study concluded that "asbestos air sampling was a conservative method for determining if additional cleaning was required." Given this conclusion and its supporting data in the Confirmation Cleaning Study and all other data sources, is the selection of asbestos as a surrogate for determining the risk from other contaminants supported? Please provide a detailed response, explaining the reasoning for your yes or no answer.*

No.

Assumptions inherent for selecting a substance as a surrogate for determining risk from other contaminants for a particular source of contaminants following cleaning of an area include at least: 1) the substance is present in the all of the distributed source material at a near uniform concentration ratio to other contaminants of concern; 2) the dispersion of the material does not cause a partitioning of surrogate and the contaminants of concern; 3) the medium the surrogate is measured in reflects the amount of the contaminants in all of the media and locations where exposure could occur; and 4) the cleaning process is at least as effective and does not discriminate for the other contaminants compared to the surrogate.

The Confirmation Cleaning Study can be used to evaluate assumption 4 and possible 3. It cannot be used to evaluate either assumptions 1 or 2 since it was limited to cleaning within a single building, so the results from that study are not representative of the material from the WTC disaster as a whole, but a relatively small subsection of the material. Samples within a single building are also not useful for understanding whether there was partition of the source material while it was being dispersed.

The Confirmation Cleaning Study examined series of contaminants of concern in the air and dust following a series of different cleaning protocols to determine whether each contaminant would be reduced to levels below its Health-Based Benchmark. As indicated in our charge, the Confirmation Cleaning Document states that the PCMe asbestos air sampling was the most sensitive of the testing methods. This statement is based on the number of times the air concentration for asbestos exceeded the Health-Based Benchmark, causing additional cleaning compared to the other contaminants. The report then states, within its Highlighted Box 7 in the Conclusion Section: "The study found that conducting asbestos sampling after cleaning could be used as a surrogate method for determining if future cleaning was needed" and presumable if the area would be below the Health-Based Benchmark suggested for all other contaminants. However, lead in surface wipes exceeded the Health-Based Benchmark in the first post cleaning samples in Units 4D and 5A when the asbestos air samples did not. Thus, if asbestos air levels

were used as a surrogate in these two apartments, lead in dust would not had been adequately abated. The wipe and micro vacuum samples for asbestos did show decreases between the pre- and some, but not all, first post-cleaning samples. The cleanings do not remove all of the contaminants from the dust within the apartments, but by three cleanings, the air levels and the dust levels were below the Health-Based Benchmarks.

Possible reasons for the asbestos air levels being acceptable but the lead dust levels still exceeding the Health-Based Benchmark is the exact mechanism for resuspension of the dust and the percent that is resuspended during the air sampling may discriminate across the particle distribution or spatially within the residence. There may be sections of the residences from which the dust is not resuspended, which may have been sampled for the wipe sample. Further, differences in the particle size and shape distributions for the different contaminants exist. Asbestos is by definition >5μm with a minimum 5:1 aspect ratio, a different size and shape than the particles expected to contain lead and other contaminants. These two size and shape particle groups may be made airborne to different degrees under the conditions of modified-aggressive air sampling.

The Confirmation Cleaning Study compared the aggressive and modified aggressive air sampling procedures by measuring air concentrations in the same apartment prior to cleaning by first doing the modified aggressive and then the aggressive air sampling. I strongly encourage that a single method be used throughout the cleanup. Using different methods leaves open the possibility that community members will claim that the two methods produce different results and results of the modified aggressive method did not adequately evaluate whether the residence was clean, since the protocol currently suggests using the aggressive techniques when the occupants agree. If EPA and the panel are convinced that the two methods are equivalent, as summarized in the Confirmation Cleaning Study, then I suggest that all homes be sampled under the modified aggressive method and this be designated in the SOP as the appropriate method, since the full aggressive method cannot be use for some occupied apartments without major movement of belongings. If the two methods are not considered equivalent then no sampling should be done under the modified aggressive method.

As indicated above, one of the assumptions inherent in the choice of asbestos air sampling being used as a surrogate for other contaminants of potential concern, is the ratio of asbestos to those contaminants should be the same in dust from the WTC in all locations that the dust was distributed to throughout lower Manhattan. There is concern that this may not be the case since asbestos was not used throughout the two buildings but rather was used as an insulator mainly in the North Tower up to the 40th floor (see, for example, Mount Sinai Pediatric Environmental Health Specialty Unit WTC Asbestos Fact Sheet). Thus, the debris created and the dust from the WTC would not be expected to be uniform for asbestos. In three samples of outdoor settled dust collected in close proximity to the WTC, within a week of the disaster, the levels of asbestos were 0.8, 0.8 and 3.0%, a range of a factor of four (Lioy et al. Characterization of the Dust/Smoke Aerosol that Settled East of the World Trade Center (WTC) in Lower Manhattan after the Collapse of the WTC, EHP 110(7) 703-714, 2002). Due to the proximity of these samples to the WTC site they should be representative of the source material without discrimination by transport. Further, the sample with the higher asbestos was collected within a block of one of the other samples and would be expected to originate from the same portion of the debris. Table 1 provides the concentration and ratios to asbestos of several key contaminants

in the two samples collected in close proximity. The ratios differ between factors of 2 to >6 for these samples.

Concentration and Ratios to Asbestos in Outdoor Dust Samples Near the WTC Site (Cherry St and Marker St are within one block of each other) (Lioy et al 2002)						
	Cortlandt St		Cherry Street		Market Street	
	Concentration	Ratio to Asbestos	Concentration	Ratio to Asbestos	Concentration	Ratio to Asbestos
Asbestos	0.8%	-	0.8%	-	3.0%	-
Lead	142 µg/g	177	489µg/g	611	289 µg/g	96
Flourene *	6.8 µg/g	8.5	2.6 µg/g	3.3	32.2 µg/g	10.7
Total PAH	383 µg/g	479	218 µg/g	272	376 µg/g	125
Dioxin	104 ng/kg	130	63ng/kg	79	103ng/kg	34
Glass Fibers	40%	50	49%	61	37%	12
*Flourene had the largest differences of the PAHs across the three sites. Cellulose makes up the difference in percent for these two samples Ratio taken without regard to differences in units						

The composition of the settled dust collected at various sites throughout lower Manhattan, suspected of having been impacted by the WTC disaster, did not contain a uniform amount of asbestos. Differences in concentrations in these samples would reflect both differences in concentrations in the sources material and discrimination in particles during transport. The USGS evaluation of the asbestos distribution showed 'an asymmetric distribution pattern. More chrysotile was detected in the east-west direction than south… While there is a general trend, it is not exclusive, meaning that chrysotile was detected in all directions. It also should be noted that samples obtained next to each other (on the map this means a city block apart) can show different results: one has asbestos, another has no chrysotile above the detection limit.)' (Clark et al, US Geological Survey, Open File Report OFR-01-0429 Environmental Studies of the World Trade Center area after the September 11, 2001 attack, http://pubs.usgs.gov/of/2001/ofr-01-0429/). These results, which refer to the percentage of the material that was asbestos, indicate that differences in the ratio of other contaminants to asbestos will exist. Thus, at least one, if not both, of the first two assumptions on the validity of using asbestos as a surrogate for other compounds that are listed in the first paragraph of this response were violated.

The use of asbestos as a surrogate for Synthetic Vitreous Fibers is questioned in the Final Report of the Public Health Investigation to Assess Potential Exposures to Airborne and Settle Surface Dust in Residential Areas of Lower Manhattan, September 2002, NYC DHMH and ATSDR-USDHHS on Page 27 where it states 'Although the presences of asbestos in the dust seems to correspond to SVF, the absence of asbestos does not predict or correspond to a presence or absence of SVF in settled surface dust, in either indoor or outdoor areas of lower Manhattan.' In Table 6 of that report, asbestos was found in 12 (18% of the locations sampled) while SVF was found in 26 (46% of the locations sampled) residences. Thus, monitoring of asbestos will not

provide documentation that there is not potential health risk from SVF. In The USEPA Region II World Trade Center Residential Dust Cleanup Program Draft Final Report, March 2004, 'the rate of exceedance of the health-based benchmarks for airborne asbestos (PCMe) was very low; approximately 0.4% of the asbestos samples exceeded the health-based benchmark. On a residence-basis, the cleanup program was successful in achieving the health-based benchmark for asbestos (PCMe) after the first cleaning approximately 99% of the time. … (for) lead wipe samples, approximately 14% of the pre-cleanup samples exceeded the HUD screening level of 25 µg/ft^2, while approximately 3% of the post-cleanup samples exceeded the screening level …. The cleanup program was successful in reducing the average dust lead loading in 31 of the 36 residences to below the 25 µg/ft^2 screening level, a success rate of approximately 86%. … The cleanup program reduced the average dust lead leading in 21 out of the 23 residences, a success rate of approximately 91%.' Since the success rate for asbestos was higher than for lead and asbestos was below the Health-Based Benchmark after the first cleaning in all cases for this report, but lead was not, using asbestos as a surrogate would result in residences not being cleaned to the Health-Based benchmark for lead in dust for a variety of residences in lower Manhattan.

2. *Do other contaminants that were measured in the Confirmation Cleaning Study provide equally good or better surrogates for determining the risk from other contaminants? If yes, please describe in detail which contaminants you would consider and why. If no, provide justification for your response.*

Yes.
As discussed in response to charge 1, whether lead in settle dust presented a health risk was not adequately represented by asbestos air concentrations. It is not clear from the data whether this is because the particles containing lead and asbestos are not resuspended in an identical manner, more of the dust needs to be cleaned to reach the lead Health-Based Benchmark in dust than was needed to reach the air asbestos Health-Based Benchmark, or if there were areas in the residence that were not cleaned adequately but were not resuspended yet were sampled by the wipe sample. I therefore suggest that in addition to the asbestos air sample, a wipe sample for lead also be analyzed to validate whether the residence has been cleaned sufficiently to reduce the risk to all contaminants of concerned in both media: air and dust.

A second consideration is there were dust samples from the WTC that do not contain asbestos but do contain other contaminants of concern. It is not clear whether lead in dust would be an adequate surrogate when asbestos is not present as lead in dust comes from many sources and may not be indicative of WTC material. It may be necessary to have an additional surrogate for air samples since asbestos has not been at measurable quantities in all locations where dust from WTC appears to have been deposited (see response to Charge 3 for one possible selection).
Rather than a different surrogate, I suggest that two additional species be measured. The first is the lead in the dust through a wipe sample.

3. Do the reviewers know of any other contaminants associated with the World Trade Center that were not included in the COPC document or the Confirmation Cleaning Study that may serve as a surrogate for determining the risk from other contaminants? If so, please provide the details regarding these contaminants and the reasons why they should

be considered. Provide citations for any references mentioned, and/or submit hard copies of the referenced documents.

As a significant portion of the dust and air samples collected from lower Manhattan (outdoor 57%, Common areas 81%, Residential 82% - Table 6 and Figure 7 – Final Report of the Public Health Investigation to Assess Potential Exposures to Airborne and Settled Surface Dust in Residential Areas of Lower Manhattan, NYCDHMH and ATSDR-USDHHS, September 2002 and from http://www.epa.gov/wtc/bulkdust/) had non-detectable levels of asbestos but were in the area impacted by WTC dust. Thus, asbestos does not serve as and adequate surrogate for the presence of WTC dust in all locations of lower Manhattan It is therefore, advisable to have an additional surrogate to indicate the presence of WTC dust that might require cleaning to reduce the levels of contaminants of concern. It is not clear whether lead in dust, the proposed addition made in response to Charge 2, would be an adequate surrogate as it could be present in dust from many other sources and may not be indicative of WTC material. One of the substances present in sample of WTC dust in high concentrations is glass fibers (Lioy et al. 2002) (not fiber glass or SVC). Glass fibers were produced as a result of the shattering and subsequent grinding of all material during the collapse of the building. The expected prevalence of glass fibers in the dust resulted from the entire outside of the buildings being covered by glass windows (600,000 sq feet of glass, Table 1 Final Report of the Public Health Investigation to Assess Potential Exposures to Airborne and Settled Surface Dust in Residential Areas of Lower Manhattan, NYCDHMH and ATSDR-USDHHS, September 2002). Glass fibers are not expected to be prevalent elsewhere, as large amounts of glass are not ground fine enough to produce fibers under most conditions. Glass fibers therefore have the potential to be an indicator of the presence of WTC materials. Its health concern is not clearly known, though glass fibers may have been implicated in irritation of the respiratory tract under heavy load conditions for adults and the “WTC Cough”. Whether there are additional concerns at lower concentrations in sensitive individuals (elderly and children) are unknown.